# 6. SUMMARY OF SITE RISKS

## 6.1 Human Health Risk Evaluation

The human health risk assessment consists of two broad phases of analysis: (1) a site and contaminant screening that identified COPCs at retained sites, and (2) an exposure route analysis for each COPC. The exposure route analysis includes an exposure assessment, a toxicity assessment, and a risk characterization discussion. The OU 2-13 baseline risk assessment includes an evaluation of human health risks associated with exposure to contaminants through soil ingestion, fugitive dust inhalation, volatile inhalation, external radiation exposure, groundwater ingestion, ingestion of homegrown produce, dermal absorption of groundwater, and inhalation of water vapors because of indoor water use.

### 6.1.1 Contaminant Identification

Historical sampling data were used to identify contaminants present in surface soils at the WAG 2 sites. The list of contaminants was screened based on comparison with background concentrations determined for the INEEL, detection frequency of less than 5% and no evidence that the contaminant was released at the site, and whether the contaminant is routinely considered to be an essential nutrient. Because substances that are essential nutrients can be toxic at high concentrations, this screening step applied only at sites where essential nutrient concentrations are less than 10 times the background concentration.

In addition, an evaluation of groundwater concentrations was conducted to ensure that contaminants that have been detected above MCLs or risk-based concentrations were not eliminated from evaluation.

### 6.1.2 Exposure Assessment

The human health exposure assessment quantifies the receptor intake of COCs for select pathways. The assessment consists of estimating the magnitude, frequency, duration, and exposure route of chemicals to humans.

***6.1.2.1 Exposure Scenarios.*** Only those exposure pathways deemed to be complete, or where a plausible route of exposure can be demonstrated from the site to an individual, were quantitatively evaluated in the risk assessment. The populations at risk because of the exposure from waste at the TRA were identified by considering both the current and future land use scenarios.

The residential scenarios model a person living on the site 350 days a year for 30 years, beginning in 2097 (100 years from 1997), and 2997 (1,000 years from 1997). The 100-year residential scenario was selected for analysis because the INEEL institutional control is currently expected to last for at least 100 years. The 1,000-year residential scenario was evaluated because 1,000 years is a sufficient period of time to allow for decay of the short half-life radionuclides at WAG 2. For purposes of the baseline risk assessment, the assumption was made that future residents will construct 10-ft basements beneath their homes, and so could be exposed to contaminants down to that depth.

The occupational scenarios model nonintrusive daily industrial use without restrictions. The two occupational scenarios that were analyzed include a current occupational scenario that lasts for 25 years from the present and a future occupational scenario that starts in 30 years and lasts for 25 years.

***6.1.2.2 Quantification of Exposure.*** The following exposure pathways were considered applicable to the evaluation of human exposure to contaminants at the TRA sites: ingestion of soil, inhalation of fugitive dust, inhalation of volatiles, external radiation exposure, groundwater ingestion (residential scenario only), ingestion of homegrown produce (residential scenario only), and inhalation of volatiles from indoor use of groundwater (residential use only). Dermal absorption risks and hazard quotients for organic contaminants contained in WAG 2 soils were calculated at all of the retained release sites evaluated in the baseline risk assessment. It was determined that dermal exposure did not contribute significantly to risk based on these calculations and combined with the knowledge that the predominant contaminants of concern at TRA (i.e., radionuclides) are not dermally absorbed to any great extent.

Adult exposures were evaluated for all scenarios and pathways (external exposure; inhalation of dust; and ingestion of soil, groundwater, and foods); child exposures (0 to 6 years old) were considered separately only for the soils ingestion pathways in the residential scenarios. Children were included because children ingest more soil than adults, significantly increasing their exposure rate.

The exposure parameters used in the risk assessment were obtained from EPA and DOE guidance. The exposure parameter default values used in the risk assessment are designed to estimate the reasonable maximum exposure at a site. Use of this approach makes under-estimation of the actual cancer risk highly unlikely. The exposure parameters used in the risk assessment were:

| | |
|---|---|
| • All pathways | |
| - Exposure frequency, residential | 350 days/yr |
| - Exposure frequency, occupational, current | 250 days/yr |
| - Exposure duration, occupational, current | 25 yr |
| • External exposure pathway | |
| - Exposure time, residential | 24 hr/day |
| - Exposure time, occupational | 8 hr/day |
| - Exposure duration, residential | 30 yr |
| • Soil ingestion pathway | |
| - Soil ingestion rate, residential, adult | 100 mg/day |
| - Soil ingestion rate, residential, child | 200 mg/day |
| - Soil ingestion rate, occupational | 50 mg/day |
| - Exposure duration, residential, adult | 24 yr |
| - Exposure duration, residential, child | 6 yr |
| • Dust inhalation pathway | |
| - Inhalation rate | 20 $m^3$ of air/day |
| - Exposure duration, residential | 30 yr |
| • Groundwater ingestion pathway | |
| - Groundwater ingestion rate, residential | 2 L/day |
| - Exposure duration, residential | 30 yr |

The contaminant exposure point concentrations evaluated in the Baseline Risk Assessment were developed from site-specific sampling information. Ninety-five percent upper confidence level (UCL)

(95% UCL) of the mean concentrations were calculated from these sampling data, and either the 95% UCL or maximum detected concentration at a given site was used as the exposure point concentration in the site's risk calculations. This analysis method was also designed to produce reasonable maximum exposure estimates for the WAG.

### 6.1.3 Toxicity Assessment

A toxicity assessment was conducted to identify potential adverse effects to humans from contaminants at the TRA. A toxicity value is the numerical expression of the substance dose-response relationship used in the risk assessment. Toxicity values (slope factors and reference doses) for the sites were obtained from EPA's Integrated Risk Information System (IRIS) database and EPA's *Health Effects Assessment Summary Tables: Annual FY-93*, ECAO-CIN-909, 1993.

### 6.1.4 Human Health Risk Characterization

Excess lifetime cancer risks are estimated by multiplying the intake level, developed using the exposure assumptions, by the slope factor. These risks are probabilities that are generally expressed in either scientific notation ($1 \times 10^{-6}$) or exponential notation (1E-06). An excess lifetime cancer risk of 1E-06 indicates that, a plausible upper bound, an individual has a one in one million chance of developing cancer over a lifetime as a result of site-related exposure to a carcinogen under the specific exposure conditions at a site. Excess cancer risks estimated below 1E-06 typically indicate that no further action is appropriate. Risks estimated in the range of 1E-04 to 1E-06 indicate that further investigation or remediation may be needed, and risks estimated above the 1E-04 typically indicate that further action is appropriate. However, the upper boundary of the risk range is not a discrete line at 1E-04, although EPA generally uses 1E-04 in making risk management decisions. A specific risk estimate around 1E-04 may be considered acceptable if justified based on site-specific conditions.

Tables 6-1 and 6-2 summarize the results of the human health evaluation with respect to the evaluated exposure routes. Table 6-1 indicates which release sites evaluated in the baseline risk assessment have predicted risks in excess of 1E-04 during the occupational 0-year or 30-year time periods, or the residential 100-year or 1,000-year time periods. Risk results are time dependent because of radioactive decay without physical source depletion. The results from the 30-year residential time period are not included because TRA is not expected to be released for residential development any sooner than 100 years in the future. Finally, Table 6-3 indicates the three sites (Chemical Waste Pond, Cold Waste Pond, and Sewage Leach Pond) with a predicted hazard index greater than one. As shown in these tables, the exposure routes that could produce unacceptable risks and hazard indexes are external radiation exposure, ingestion of soil, ingestion of homegrown produce, and inhalation of fugitive dust. Table 6-4 provides a summary of sites that pose an unacceptable risk to ecological receptors.

The contaminants with the greatest potential for causing adverse human health effects at WAG 2 (i.e., risks greater than 1E-04 or hazard index greater than 1.0) include four radionuclides and four metals. In general, radionuclide contamination in shallow soils represents the greatest health risk identified at the WAG. The contaminants with calculated risks greater than 1E-06 and/or calculated hazard indexes greater than 1.0 are considered to be COCs for WAG 2. These are shown in Table 6-5. Tables 6-6 and 6-7 list sites determined to present risks greater than 1E-04 or a hazard index greater than 1, respectively, for one or more exposure scenarios.

**Table 6-1**. Summary of sites and exposure routes with calculated risks greater than or equal to 1E-04.

| | Occupational Scenario | | | | | Residential Scenario | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Soil | | Air | | | Soil | | | Air | | |
| Submit | Ingestion of Soil | External Radiation Exposure | Inhalation of Fugitive Dust | Inhalation of Volatiles | Cumulative Total | Ingestion of Soil | External Radiation Exposure | Ingestion of Home Grown Produce | Inhalation of Fugitive Dust | Inhalation of Volatiles | Cumulative Total[a] |
| TRA-15 | | ● | | | ● | | ○ | | | | ○ |
| TRA-19 | ○ | ● | | | ● | | ○ | | | | ○ |
| TRA-08 (CWP[b]) | | ○ | | | ○ | ● | | | | | ● |
| TRA-13 (SLP[c]) | | ● | | | ● | | ○ | | | | ○ |
| SLP-Berm ad SCA[d] | | ○ | | | ○ | | ○ | | | | ○ |
| | ○ | ○ | | | ● | ○ | ○ | | | | ● |
| TRA-03 (WWP[e] 1964 cell) | | ● | | | | | | | | | |
| Brass Cap Area | ○ | ● | | | ● | | ○ | | | | ○ |

a. Includes risks for groundwater scenarios (ingestion, dermal absorption, and inhalation of vapors from indoor use).

b. CWP = Cold Waste Pond.

c. SLP = Sewage Leach Pond.

d. SCA = Soil Contamination Area.

e. WWP = Warm Waste Pond.

● Risk greater than or equal to 1E-04 by exposure route for the occupational scenario (both the present time and 30 years in the future) and for the residential scenario (both 100 years and 1,000 years into the future).

○ Risk greater than or equal to 1E-04 for the earlier time periods (occupational scenario at the present time or residential scenario 100 years in the future), and less than 1E-06 for the later period (occupational at 30 years into the future or 1,000 years into the future).

**Table 6-2.** Summary of sites and exposure routes with calculated risks greater than or equal to 1E-06.

| | Occupational Scenario | | | | | Residential Scenario | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Soil | | Air | | | Soil | | | Air | | |
| Subunit | Ingestion of soil | External radiation exposure | Inhalation of fugitive dust | Inhalation of volatiles | Cumulative Total | Ingestion of soil | External radiation exposure | Ingestion of homegrown produce | Inhalation of fugitive dust | Inhalation of volatiles | Cumulative Total[a] |
| TRA-34 (NSA[b]) | | ● | | | ● | | ○ | | | | ● |
| TRA-619 (PCB spill) | | | | | | ● | | ● | | | ● |
| TRA-626 (PCB spill) | | | | | | ● | | ● | | | ● |
| TRA-653 (PCB spill) | ● | | | | ● | ● | | ● | | | ● |
| TRA-15 | ● | ● | | | ● | ● | ● | ○ | | | ● |
| TRA-16 | | | | | | | | | | | ● |
| TRA-19 | ● | ● | | | ● | ○ | ○ | ○ | | | ● |
| TRA-08 (CWP[c]) | ● | ● | | | ● | ● | ○ | ● | | | ● |
| TRA-13 (Sewage Leach Pond) | | ● | | | ● | | ● | | | | ● |
| SLP[d]-Berm and SCA[e] | | ● | | | ● | | ○ | | | | ● |
| TRA-03 (WWP[f] 1952 and 1957 cells) | ● | ● | | | ● | ● | ● | ● | | | ● |
| TRA-03 (WWP 1964 cell) | | | | | | | | | | | ● |
| TRA-04 (Ret. Basin) | ● | ● | | | ● | ● | ● | ● | | | ● |
| TRA-06 (CP[g]) | ● | | | | ● | ● | | ● | | | ● |
| Brass Cap Area | ● | ● | | | ● | ○ | ○ | ○ | | | ● |
| TRA-41 (French Drain) | | | | | | | | | | | ● |
| HTS | | ● | | | ● | | ○ | | | | ● |

**Table 6-2**. (continued).

| | Occupational Scenario | | | | | Residential Scenario | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Soil | | Air | | | Soil | | | Air | | |
| Subunit | Ingestion of soil | External radiation exposure | Inhalation of fugitive dust | Inhalation of volatiles | Cumulative Total | Ingestion of soil | External radiation exposure | Ingestion of homegrown produce | Inhalation of fugitive dust | Inhalation of volatiles | Cumulative Total[a] |
| ETR Stack | ● | | | | ● | ● | | ● | | | ● |

a. Includes risks for groundwater scenarios (ingestion, dermal absorption, and inhalation of vapors from indoor use).

b. NSA = North Storage Area.

c. CWP = Cold Waste Pond.

d. SLP = Sewage Leach Pond.

e. SCA = Soil Contamination Area.

f. WWP = Warm Waste Pond.

g. CP = Chemical Waste Pond.

● Risk greater than or equal to 1E-06 for both exposure scenario time periods (occupational 0-year and 30-year, or residential 100-year and 1,000-year).

○ Risk greater than or equal to 1E-06 for earlier time period (occupational 0-year or residential 100-year), and less than 1E-06 for later period (occupational 30-year or residential 1,000-year).

**Table 6-3**. Summary of sites and exposure routes with calculated hazard index greater than or equal to one.

| | Occupational Scenario | | | | | Residential Scenario | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Soil | | Air | | | Soil | | | Air | | |
| Submit | Ingestion of Soil | External Radiation Exposure | Inhalation of Fugitive Dust | Inhalation of Volatiles | Cumulative Total | Ingestion of Soil | External Radiation Exposure | Ingestion of Home Grown Produce | Inhalation of Fugitive Dust | Inhalation of Volatiles | Cumulative Total[a] |
| TRA-08 (CWP[b]) | | | | | | | | | • | | |
| TRA-13 (SLP[c]) | | | | | | | | • | • | | |
| TRA-06 (CP[d]) | | | | | | • | | • | • | | |

a. Includes risks for groundwater scenarios (ingestion, dermal absorption, and inhalation of vapors from indoor use).

b. CWP = Cold Waste Pond.

c. SLP = Sewage Leach Pond.

d. CP = Chemical Waste Pond.

• Hazard index greater than one by exposure route for the occupational scenario (both the present and 30 years into the future), and for the residential scenario (both the 100 years and 1,000 years into the future).

**Table 6-4**. Summary of the sites that have the potential to pose an unacceptable risk to ecological receptors.

| | Nonradionuclides | | Radionuclides | |
|---|---|---|---|---|
| Site | Metal | Organic Compound | Internal | External |
| TRA-02[a] | ●[b] | ●[b] | | |
| TRA-03 | ●[c] | | ●[c] | |
| TRA-04/05[a] | ●[d] | ●[d] | | |
| TRA-06 | ●[e] | | | |
| TRA-08[a] | ●[f] | | | |
| TRA-13[a] | ●[g] | | | |
| TRA-15[a] | ●[h] | | | |
| TRA-16[a] | ●[i] | | | |
| TRA-19[a] | | | ●[j] | ●[j] |
| TRA-36 | ●[k] | | | |
| TRA-38[a] | ●[l] | | | |
| Brass Cap Area[a] | | | ●[j] | ●[j] |

a. Co-located facilities that are currently in use and/or near areas of industrial activity.

b. At TRA-02, the metals are antimony, lead, selenium, silver, thallium, and tin. The organic compound is benzo(b)fluroanthene.

c. At TRA-03, the metal is mercury and the radionuclides are americium-241, curium-244, plutonium-238, plutonium-239/240, and strontium-90.

d. At TRA-04/05, the metals are arsenic, copper, lead, mercury, selenium, and thallium; the organic compound is acrylonitrile.

e. At TRA-06, the metals are antimony, arsenic, barium, lead, mercury, selenium, silver, strontium, thallium, and tin.

f. At TRA-08, the metals are arsenic, barium, cadmium, copper, lead, mercury, selenium, and silver.

g. At TRA-13, the metals are copper, lead, mercury, selenium, silver, and zinc.

h. At TRA-15, the metals are arsenic, fluoride, and mercury.

i. At TRA-16, the metal is mercury.

j. At TRA-19 and the Brass Cap Area, the internal and external radionuclides are cesium-134 and cesium-137.

k. At TRA-36, the metal is selenium. (Cadmium and zinc also had hazard quotients >1; however, these contaminants would pose risk at background levels and are not considered a problem at this site.)

l. At TRA-38, the metals are antimony, arsenic, lead, mercury, selenium, and thallium.

**Table 6-5.** WAG 2 contaminants of concern.

| Exposure Scenario | Radionuclides | Metals | Organic Contaminants | Other |
|---|---|---|---|---|
| Occupational | Ag-108m, Co-60, Cs-134, Cs-137, Eu-152, Eu-154, Sr-90 | Arsenic | None | PCBs |
| Residential | Ag-108m, Am-241, Cs-134, Cs-137, Co-60, Pu-238, Pu-239, Sr-90, Th-228, U-238 | Arsenic, beryllium, chromium, mercury | Acrylonitrile | PCBs |

**Table 6-6**. Contaminants and exposure pathways of concern for OU 2-13 sites with risks >1E-06 and cumulative risks >1E-04.[a]

| Site/Exposure Scenario | Pathway | Contaminants of Concern | Excess Cancer Risk |
|---|---|---|---|
| **TRA-03 (Warm Waste Pond)** | | | |
| Occupational 0-year | Soil ingestion | Am-241 | 2E-05 |
| | | Cs-137 | 2E-05 |
| | | Pu-238 | 1E-06 |
| | | Pu-239/240 | 2E-05 |
| | | Sr-90 | 4E-05 |
| | External radiation exposure | Ag-108m | 3E-05 |
| | | Am-241 | 4E-06 |
| | | Co-60 | 9E-04 |
| | | Cs-137 | 2E-02 |
| | | Eu-152 | 2E-03 |
| | | Eu-154 | 5E-04 |
| | **Exposure scenario total** | | **2E-02** |
| Occupational 30-year | Soil ingestion | Am-241 | 2E-05 |
| | | Cs-137 | 8E-06 |
| | | Pu-238 | 1E-06 |
| | | Pu-239/240 | 2E-05 |
| | | Sr-90 | 2E-05 |
| | External radiation exposure | Ag-108m | 2E-05 |
| | | Am-241 | 4E-06 |
| | | Co-60 | 2E-05 |
| | | Cs-137 | 1E-02 |
| | | Eu-152 | 5E-04 |
| | | Eu-154 | 4E-05 |
| | **Exposure scenario total** | | **1E-02** |
| Residential 100-year | Soil ingestion | As | 5E-06 |
| | | Am-241 | 5E-05 |
| | | Cs-137 | 6E-06 |
| | | Pu-238 | 2E-06 |
| | | Pu-239/240 | 7E-05 |
| | | Sr-90 | 2E-05 |
| | Homegrown produce ingestion | Cs-137 | 2E-06 |
| | | Pu-239/240 | 3E-05 |
| | | Sr-90 | 2E-05 |
| | External radiation exposure | Ag-108m | 7E-05 |
| | | Am-241 | 2E-05 |
| | | Cs-137 | 9E-03 |
| | | Eu-152 | 6E-05 |
| | | U-238 | 2E-06 |

**Table 6-6.** (continued).

| Site/Exposure Scenario | Pathway | Contaminants of Concern | Excess Cancer Risk |
|---|---|---|---|
| | **Exposure scenario total** | | **9E-03** |
| Residential 1,000-year | Soil ingestion | As | 5E-06 |
| | | Am-241 | 1E-05 |
| | | Pu-239/240 | 7E-05 |
| | Homegrown produce ingestion | Pu-239/240 | 3E-05 |
| | External radiation exposure | Am-241 | 4E-06 |
| | | U-238 | 2E-06 |
| | **Exposure scenario total** | | **1E-04** |
| **TRA-06 (Chemical Waste Pond)** | | | |
| Occupational 0-year | Soil ingestion | As | 2E-06 |
| | **Exposure scenario total** | | 2E-06 |
| Occupational 30-year | Soil ingestion | As | 2E-06 |
| | **Exposure scenario total** | | 2E-06 |
| Residential 100-year | Soil ingestion | Aroclor-1260 | 1E-06 |
| | | As | 2E-05 |
| | Homegrown produce ingestion | As | 2E-06 |
| | **Exposure scenario total** | | 2E-05 |
| Residential 1,000-year | Soil ingestion | Aroclor-1260 | 1E-06 |
| | | As | 2E-05 |
| | Homegrown produce ingestion | As | 2E-06 |
| | **Exposure scenario total** | | 2E-05 |
| **TRA-08 (Cold Waste Pond)** | | | |
| Occupational 0-year | Soil ingestion | As | 1E-05 |
| | External radiation exposure | Co-60 | 1E-05 |
| | | Cs-137 | 1E-04 |
| | | Eu-154 | 7E-06 |
| | **Exposure scenario total** | | **1E-04** |
| Occupational 30-year | Soil ingestion | As | 1E-05 |
| | External radiation exposure | Cs-137 | 7E-05 |
| | **Exposure scenario total** | | 8E-05 |
| Residential 100-year | Soil ingestion | As | 1E-04 |

**Table 6-6.** (continued).

| Site/Exposure Scenario | Pathway | Contaminants of Concern | Excess Cancer Risk |
|---|---|---|---|
| | Homegrown produce ingestion | As | 1E-05 |
| | External radiation exposure | Cs-137 | 7E-05 |
| | | As | 1E-05 |
| | **Exposure scenario total** | | **2E-04** |
| Residential 1,000-year | Soil ingestion | As | 1E-04 |
| | Homegrown produce ingestion | As | 1E-05 |
| | **Exposure scenario total** | | **1E-04** |
| **TRA-13 (Sewage Leach Pond)** | | | |
| Occupational 0-year | External radiation exposure | Ag-108m | 5E-05 |
| | | Co-60 | 4E-04 |
| | | Cs-134 | 1E-06 |
| | | Cs-137 | 7E-04 |
| | | Eu-152 | 2E-05 |
| | | Eu-154 | 1E-05 |
| | **Exposure scenario total** | | **1E-03** |
| Occupational 30-year | External radiation exposure | Ag-108m | 4E-05 |
| | | Co-60 | 8E-06 |
| | | Cs-137 | 4E-04 |
| | | Eu-152 | 5E-06 |
| | **Exposure scenario total** | | **4E-04** |
| Residential 100-year | External radiation exposure | Ag-108m | 1E-04 |
| | | Cs-137 | 4E-04 |
| | **Exposure scenario total** | | **5E-04** |
| Residential 1,000-year | External radiation exposure | Ag-108m | 1E-06 |
| | **Exposure scenario total** | | 1E-06 |
| **TRA-15** | | | |
| Occupational 0-year | External radiation exposure | Co-60 | 1E-05 |
| | | Cs-134 | 1E-06 |
| | | Cs-137 | 3E-04 |
| | **Exposure scenario total** | | **3E-04** |
| Occupational 30-year | External radiation exposure | Cs-137 | 2E-04 |
| | **Exposure scenario total** | | **2E-04** |
| Residential 100-year | Soil ingestion | As | 1E-05 |

**Table 6-6.** (continued).

| Site/Exposure Scenario | Pathway | Contaminants of Concern | Excess Cancer Risk |
|---|---|---|---|
| | Homegrown produce ingestion | As | 1E-06 |
| | External radiation exposure | Cs-137 | 1E-04 |
| | **Exposure scenario total** | | **1E-04** |
| Residential 1,000-year | Soil ingestion | As | 1E-05 |
| | Homegrown produce ingestion | As | 1E-06 |
| | **Exposure scenario total** | | 1E-05 |
| **TRA-19** | | | |
| Occupational 0-year | Soil ingestion | Cs-134<br>Cs-137<br>Sr-90 | 6E-06<br>1E-04<br>1E-05 |
| | External radiation exposure | Co-60<br>Cs-134<br>Cs-137 | 1E-04<br>1E-02<br>2E-01 |
| | **Exposure scenario total** | | **2E-01** |
| Occupational 30-year | Soil ingestion | Cs-137<br>Sr-90 | 7E-05<br>5E-06 |
| | External radiation exposure | Co-60<br>Cs-137 | 3E-06<br>8E-02 |
| | **Exposure scenario total** | | **8E-02** |
| Residential 100-year | Soil ingestion | Cs-137<br>Sr-90 | 6E-05<br>4E-06 |
| | Homegrown produce ingestion | Cs-137<br>Sr-90 | 1E-05<br>6E-06 |
| | External radiation exposure | Cs-137 | 8E-02 |
| | **Exposure scenario total** | | **8E-02** |
| **Sewage Leach Pond-Soil Contamination Area and Berms** | | | |
| Occupational 0-year | External radiation exposure | Ag-108m<br>Co-60<br>Cs-137 | 1E-05<br>1E-04<br>1E-04 |
| | **Exposure scenario total** | | **2E-04** |
| Occupational 30-year | External radiation exposure | Ag-108m<br>Co-60<br>Cs-137 | 1E-05<br>2E-06<br>7E-05 |

**Table 6-6.** (continued).

| Site/Exposure Scenario | Pathway | Contaminants of Concern | Excess Cancer Risk |
|---|---|---|---|
| | **Exposure scenario total** | | 8E-05 |
| Residential 100-year | External radiation exposure | Ag-108m | 3E-05 |
| | | Cs-137 | 6E-05 |
| | **Exposure scenario total** | | 9E-05 |
| **Brass Cap Area** | | | |
| Occupational 0-year | Soil ingestion | Cs-134 | 6E-06 |
| | | Cs-137 | 1E-04 |
| | | Sr-90 | 1E-05 |
| | External radiation exposure | Co-60 | 1E-04 |
| | | Cs-134 | 1E-02 |
| | | Cs-137 | 2E-01 |
| | **Exposure scenario total** | | **2E-01** |
| Occupational 30-year | Soil ingestion | Cs-137 | 7E-05 |
| | | Sr-90 | 5E-06 |
| | External radiation exposure | Co-60 | 3E-06 |
| | | Cs-137 | 8E-02 |
| | **Exposure scenario total** | | **8E-02** |
| Residential 100-year | Soil ingestion | Cs-137 | 6E-05 |
| | | Sr-90 | 4E-06 |
| | Homegrown produce ingestion | Cs-137 | 1E-05 |
| | | Sr-90 | 6E-06 |
| | External radiation exposure | Cs-137 | 8E-02 |
| | **Exposure scenario total** | | **8E-02** |

a. Total site risks >1E-04 are shown in bold.

**Table 6-7.** Contaminants and exposure pathways of concern for OU 2-13 sites with hazard indexes >1.0.[a]

| Site/Exposure Scenario | Pathway | Contaminants of Concern | Hazard Index |
|---|---|---|---|
| **TRA-03 (Warm Waste Pond)** | | | |
| Residential 100-year | Homegrown produce ingestion | Hg | 6E-01 |
| | **Exposure scenario total** | | 6E-01 |
| **TRA-06 (Chemical Waste Pond)** | | | |
| Occupational 0-year | Soil ingestion | Hg | 2E-01 |
| | **Exposure scenario total** | | 2E-01 |
| Occupational 30-year | Soil ingestion | Hg | 2E-01 |
| | **Exposure scenario total** | | 2E-01 |
| Residential 100-year | Soil ingestion | Hg | 2E+00 |
| | | Sb | 1E-01 |
| | Homegrown produce ingestion | Ba | 5E-01 |
| | | Hg | 7E+01 |
| | | Mn | 3E-01 |
| | | Zn | 3E-01 |
| | **Exposure scenario total** | | **7E+01** |
| Residential 1,000-year | Soil ingestion | Hg | 2E+00 |
| | | Sb | 1E-01 |
| | Homegrown produce ingestion | Ba | 5E-01 |
| | | Hg | 7E+01 |
| | | Mn | 3E-01 |
| | | Zn | 3E-01 |
| | **Exposure scenario total** | | **7E+01** |
| **TRA-08 (Cold Waste Pond)** | | | |
| Residential 100-year | Soil ingestion | As | 5E-01 |
| | Homegrown produce ingestion | Ba | 1E-01 |
| | | Cd | 2E-01 |
| | | Hg | 3E-01 |
| | **Exposure scenario total** | | **1E+00** |
| Residential 1,000-year | Soil ingestion | As | 5E-01 |
| | Homegrown produce ingestion | Ba | 1E-01 |
| | | Cd | 2E-01 |
| | | Hg | 3E-01 |
| | **Exposure scenario total** | | **1E+00** |

**Table 6-7.** (continued).

| Site/Exposure Scenario | Pathway | Contaminants of Concern | Hazard Index |
|---|---|---|---|
| **TRA-13 (Sewage Leach Pond)** | | | |
| Residential 100-year | Homegrown produce ingestion | Hg | 2E+00 |
| | | Zn | 2E+00 |
| | **Exposure scenario total** | | **4E+00** |
| Residential 1,000-year | Homegrown produce ingestion | Hg | 2E+00 |
| | | Zn | 2E+00 |
| | **Exposure scenario total** | | **4E+00** |
| **TRA-15** | | | |
| Residential 100-year | Soil ingestion | F | 1E-01 |
| | **Exposure scenario total** | | 1E-01 |
| Residential 1,000-year | Soil ingestion | F | 1E-01 |
| | **Exposure scenario total** | | 1E-01 |

a. Total site hazard indexes are shown in bold.

Additional exposure routes that have calculated 100-year future residential risks within or above the National Contingency Plan (NCP) target risk range (one in ten thousand to one in one million excess cancer risk) at WAG 2 are ingestion of soil, ingestion of homegrown produce, and ingestion of groundwater. Estimated risks for ingestion of soil are within or above the target risk range at the TRA-619, TRA-626, TRA-653 PCB Spill Sites, the TRA-15 soil surrounding the Hot Waste Storage Tanks at TRA-613, the TRA-19 soil surrounding the Rad Tanks at TRA-630, the TRA-08 Cold Waste Pond, the TRA-03 Warm Waste Pond 1952 and 1957 cells, the TRA-04/05 soil between 0 and 10 ft below land surface surrounding the Retention Basin, the TRA-06 Chemical Waste Pond, the Brass Cap Area, and the Experimental Test Reactor Stack. Estimated risks for ingestion of homegrown produce are within or above the target risk range at the TRA-619, TRA-626, TRA-653 PCB Spill Sites, the TRA-15 soil surrounding the Hot Waste Storage Tanks at TRA-613, the TRA-19 soil surrounding the Rad Tanks at TRA-630, the TRA-08 Cold Waste Pond, the TRA-03 Warm Waste Pond 1952 and 1957 cells, the TRA-04/05 soil between 0 and 10 ft below land surface surrounding the Retention Basin, the TRA-06 Chemical Waste Pond, the Brass Cap Area, and the Experimental Test Reactor Stack. Estimated risk for external radiation exposure is within or above the target risk range at the North Storage Area, the TRA-15 soil surrounding Hot Waste Storage Tanks at TRA-613, the TRA-19 soil surrounding Rad Tank at TRA-630, the TRA-08 Cold Waste Pond, the TRA-04/05 soil between 0 and 10 ft below land surface surrounding the Retention Basin and the Cold Waste Sampling Pit and Sump, SLP-Berm and Soil Contamination Area, the Brass Cap Area, and the Hot Tree Site, in addition to the Sewage Leach Pond and the Warm Waste Pond 1952 and 1957 cells.

Recent investigations have determined that RCRA-listed waste may have been present in the TRA warm and hot waste systems when leaks to the environment occurred. Therefore, if excavation occurs, soils will be managed in a manner consistent with the hazardous waste determination to be performed at the time of the remedial action.

### 6.1.5 Human Health Risk Uncertainty

Many of the parameter uncertainty values used to calculate risks in the WAG 2 Baseline Risk Assessment and Ecological Risk Assessment (ERA) are uncertain. For example, limitations in site sampling produce some uncertainty associated with the extent of contamination at most of the WAG 2 sites. Limitations in the characterization of the WAG 2 physical environment produce some uncertainty associated with fate and transport properties of WAG 2 contaminants. To offset these uncertainties, parameter values were selected for use in the Baseline Risk Assessment and ERA so that the assessment's results would present an upper bound, and yet reasonable, estimate of WAG 2 risks. Assumptions and supporting rationale, along with potential impacts on the uncertainty, are included in Table 6-8.

## 6.2 Ecological Evaluation

The ecological assessment of the TRA is a qualitative evaluation of the potential effects of the sites on plants and animals other than people and domesticated species. A quantitative ecological assessment is planned in conjunction with the INEEL-wide comprehensive RI/FS scheduled for 1998. This INEEL-wide ecological assessment will provide an indication of the affect of INEEL releases in the ecology at a population level. There are no critical or sensitive habitats on or near TRA. Based on the present contaminant and ecological information and the qualitative eco-evaluation performed for this ROD, the remedies selected to address human health risks will serve to reduce the ecological risk posed at seven sites where both human health and potential ecological risk have been identified. The need for remedial action will be reconsidered at these sites as well as the remaining five sites if the INEEL-wide ecological risk assessment suggests that these conclusions are not well founded. However, it is unlikely that the INEEL-wide comprehensive RI/FS ecological assessment will identify the need for any additional actions at these sites.

Table 6-4 summarizes the results of the ERA evaluation for those sites that have potential to pose an unacceptable risk to ecological receptors.

### 6.2.1 Species of Concern

The only federally listed endangered species known to frequent the INEEL is the peregrin falcon. The status of the bald eagle in the lower 48 United States was changed from endangered to threatened in July 1995. Several other species observed on the INEEL are the focus of varying levels of concern by either federal or state agencies. Animal and avian species include the ferruginous hawk, the northern goshawk, the sharp-tailed grouse, the loggerhead shrike, the Townsend's big-eared bat, the pygmy rabbit, the gyrfalcon, the boreal owl, the flammulated owl, the Swainson's hawk, the merlin, and the burrowing owl. Plant species classified as sensitive include Lemhi milkvetch, plains milkvetch, wing-seed evening primrose, nipple cactus, and oxytheca.

**Table 6-8.** Human health assessment uncertainty factors.

| Uncertainty factor | Effect of uncertainty | Comment |
|---|---|---|
| Source term assumptions | May overestimate risk | All contaminants are assumed to be completely available for transportation away from the source zone. In reality, some contaminants may be chemically or physically bound to the source zone and unavailable for transport. |
| Natural infiltration rate | May overestimate risk | A conservative value of 10 cm/yr was used for this parameter. |
| Moisture content | May overestimate or underestimate risk | Soil moisture contents vary seasonally in the upper vadose zone and may be subject to measurement error. |
| Water table fluctuations | May slightly overestimate or underestimate risk | The average value used is expected to be representative of the depth over the 30-year exposure period. |
| Mass of contaminants in soils estimated by assuming a uniform contamination concentration in the source zone. | May overestimate or underestimate risk | There is a possibility that most of the mass of a given contaminant at a given site may exist in a hotspot that was not detected by sampling. If this condition existed, the mass of the contaminant used in the analysis might be underestimated. However, 95% UCLs or maximum detected contamination were used for all mass calculations, and these concentrations are assumed to exist at every point in each waste site, so the mass of contaminants used in the analysis is probably overestimated. |
| Plug flow assumption in groundwater transport | Could overestimate or underestimate risk | Plug flow models are conservative with respect to concentrations because dispersion is neglected, and mass fluxes from the source to the aquifer differ only by the time delay in the unsaturated zone (the magnitude of the flux remains unchanged). For nonradiological contaminants, the plug flow assumption is conservative because dispersion is not allowed to dilute the contaminant groundwater concentrations. For radionuclides, the plug flow assumption may or may not be conservative. Based on actual travel time, the radionuclide groundwater concentrations could be over or underestimated because a longer travel time allows for more decay. If the concentration decrease due to the travel time delay is larger than the neglected dilution due to dispersion, the model will not be conservative. |
| No migration of contaminants from the soil source before 1994 | Could overestimate or underestimate risk | The effect of not modeling contaminant migration from the soil before 1994 is dependent on the contaminant half-life, radioactive ingrowth, and mobility characteristics. |
| Chemical form assumptions | Could overestimate or underestimate risk | In general, the methods and inputs used in contaminant migration calculations, including assumptions made regarding chemical forms of contaminants were chosen in order to err on the protective side. All contaminant concentration and mass are assumed available for transport. This assumption results in a probable overestimate of risk. |

Table 6-8. (continued).

| Uncertainty factor | Effect of uncertainty | Comment |
|---|---|---|
| Exposure scenario assumptions | May overestimate risk | The likelihood of future scenarios has been qualitatively evaluated as follows:<br>resident—improbable<br>industrial—credible.<br><br>The likelihood of future onsite residential development is small. If future residential use of this site does not occur, then the risk estimates calculated for future onsite residents are likely to overestimate the true risk associated with future use of this site. |
| Exposure parameter assumptions | May overestimate risk | Assumptions regarding media intake, population characteristics, and exposure patterns may not characterize actual exposures. |
| Receptor locations | May overestimate risk | Groundwater ingestion risks are calculated for a point at the downgradient edge of an equivalent rectangular area. The groundwater risk at this point is assumed to be the risk from groundwater ingestion at every point within the TRA boundaries. Changing the receptor location will only affect the risks calculated for the groundwater pathway since all other risks are site-specific or assumed constant at every point within the TRA boundaries. |
| For the groundwater pathway analysis, all contaminants were assumed to be homogeneously distributed in a large mass of soil. | May overestimate or underestimate risk | The total mass of each COPC is assumed to be homogeneously distributed in the soil volume beneath TRA. This assumption tends to maximize the estimated groundwater concentrations produced by the contaminant inventories because homogeneously distributed contaminants would not have to travel far to reach a groundwater well drilled anywhere within the TRA boundary. However, groundwater concentrations may be underestimated for a large mass of contamination (located in a small area with a groundwater well drilled directly downgradient). |
| The entire inventory of each contaminant is assumed to be available for transport along each pathway | May overestimate risk | In reality, only a portion of each contaminant's inventory will be transported by each pathway. |
| Exposure duration | May overestimated | The assumption that an individual will work or reside at the site for 25 or 30 years is conservative. Short-term exposures involve comparison to subchronic toxicity values, which are generally less restrictive than chronic values. |
| Noncontaminant-specific constants (not dependent on contaminant properties) | May overestimate risk | Conservative or upper bound values were used for all parameters incorporated into intake calculations. |
| Exclusion of some hypothetical pathways from the exposure scenarios | May underestimate risk | Exposure pathways are considered for each scenario and eliminated only if the pathway is either incomplete or negligible compared to other evaluated pathways. |
| Model does not consider biotic decay | May overestimate risk | Biotic decay would tend to reduce contamination over time. |

**Table 6-8.** (continued).

| Uncertainty factor | Effect of uncertainty | Comment |
|---|---|---|
| Occupational intake value for inhalation is conservative | Slightly overestimates risk | Standard exposure factors for inhalation have the same value for occupational as for residential scenarios although occupational workers would not be onsite all day. |
| Use of cancer slope factors | May overestimate risk | Slope factors are associated with upper 95th percentile confidence limits. They are considered unlikely to underestimate true risk. |
| Toxicity values derived primarily from animal studies | May overestimate or underestimate risk | Extrapolation from animal to humans may induce error due to differences in absorption, pharmacokinetics, target organs, enzymes, and population variability. |
| Toxicity values derived primarily from high doses, most exposures are at low doses | May overestimate or underestimate risk | Assumes linearity at low dose. Tend to have conservative exposure assumptions. |
| Toxicity values and classification of carcinogens | May overestimate or underestimate risk | Not all values represent the same degree of certainty. All are subject to change as new evidence becomes available. |
| Lack of slope factors | May underestimate risk | COPCs without slope factors may or may not be carcinogenic through the oral pathway. |
| Lack of RfDs | May underestimate risk | COPCs without RfDs may or may not have noncarcinogenic adverse effects. |
| Risk/HQs summed across pathways | May overestimate risk | Not all of the COPC inventory will be available for exposure through all applicable exposure pathways. |

### 6.2.2 Exposure Assessment

Three primary media were identified to have the potential for posing risk to WAG 2 ecological components: contaminated surface soil, contaminated subsurface soil, and contaminated surface water. Ingestion of contaminated groundwater was not considered because groundwater is not accessible to ecological receptors. For plants, the uptake of contaminants through root systems was considered.

The amount of exposure is directly related to the amount of time spent and the fraction of diet taken on the sites. Therefore exposures are greatest for permanent ecological residents, particularly plants and small burrowing animals. The small size of the sites of concern at WAG 2 is expected to minimize the exposures received by migratory species, which include most avian and large mammal species that inhabit the INEEL.

Table 6-4 summarizes the results of the ERA evaluation for those sites that pose an unacceptable risk to ecological receptors.

### 6.2.3 Ecological Risk Evaluation

Of the sites and COPCs assessed, two sites were eliminated as posing no potential risk to ecological receptors (TRA-39 and the ETR Stack). In addition, TRA-34, TRA-619, TRA-626, and TRA-653 were determined to be highly unlikely to pose risk to ecological receptors and, therefore, were eliminated from consideration. The PCB sites (TRA-619, 626, and 653) exceeded the target value for only one functional group (avian insectivores). Given the size of these sites, it is highly unlikely that the member of this group (swallows) would have an exposure that would result in adverse effects. The sites were therefore eliminated. For site TRA-39, no contaminant exceeded the target value; therefore, this site was eliminated from further consideration. The results of the assessment indicate risk at the remaining 12 sites as follows: from internal and external exposure to radionuclides at the Brass Cap Area and TRA-19 soil surrounding Rad Tanks 1 and 2 at TRA-630; from internal exposure to radionuclides at TRA-03 Warm Waste Pond, as well as from a metal at TRA-03; and from both metals and organic compounds at the following sites: TRA-02 TRA Paint Shop Ditch, TRA-04/05 Warm Waste Retention Basin and Sampling Pit, TRA-06 Chemical Waste Pond, TRA-08 Cold Waste Pond, TRA-13 Sewage Leach Ponds, TRA-15 Hot Waste Tanks at TRA-613, TRA-16 Inactive Radioactive Contaminated Tank at TRA-614, TRA-36 ETR Cooling Tower Basin, and TRA-38 ATR Cooling Tower. These sites are all associated with ongoing TRA facility operations. For a complete description of the ecological risk assessment process, please refer to the WAG 2 Comprehensive Remedial Investigation/Feasibility Study Report located in the administrative record. The TRA-02 Paint Shop Ditch, TRA-04/05 Warm Waste Retention Basin and Sampling Pit, TRA-16 Inactive Radioactive Contaminated Tank at TRA-614, TRA-36 ETR Cooling Tower Basin, and TRA-38 ATR Cooling Tower sites pose only a potential ecological risk.

A basic assumption of the ERA is that, under a future-use scenario, the contamination is present at an abandoned site that will not be institutionally controlled. In actuality, co-located facilities are currently in use, and institutional controls will remain in place until they are decommissioned. Because these sites are at an industrial facility that is currently in use, they most likely do not contain desirable or valuable habitat. The absence of habitat, the existence of facility activities, and institutional controls will minimize the exposure of ecological receptors.

The ERA determined that risks to ecological receptors may exist at 12 sites at WAG 2. Four sites (TRA-03, TRA-06, TRA-08, and TRA-13) are outside the TRA facility fence. Human health risks exceeding allowable levels exist at these sites, and some level of remediation ranging from institutional controls to active remediation will be required. Any remedial alternative that reduces human health risks would be expected to also reduce ecological risks. The remaining sites are inside the facility fence, where ongoing facility operations result in limited ecological exposures, as discussed previously. The relatively small size of these sites, including TRA-02, -16, and -38, would also likely result in little or no ecological risks. The results of these studies can be found in the Environmental Science and Research Foundation 1996 Annual Technical Report, located in Idaho Falls, Idaho.

Recent D&D activities during the summer of 1996 at the TRA-645 building discovered radioactive barn swallow nests. Barn swallows are common at most facilities on the INEEL and are know to nest near many wastewater ponds found on the site. In a study conducted in 1976 through 1978, barn swallows nesting at the TRA were found to build nests with radionuclide-contaminated materials and to accumulate radionuclides internally by ingesting arthropods from radioactive leach ponds. The results of this study indicate that no obvious direct effects to the barn swallows or their clutches were found. Recent studies conducted in 1995 showed that average radionuclide concentrations in adult barn swallows are about 54 to 314 times lower than those observed in the 1976 study.

### 6.2.4 Ecological Risk Uncertainty

Uncertainty is inherent in the risk process. Principal sources of uncertainty lie within the development of an exposure assessment. Uncertainties inherent in the exposure assessment are associated with estimation of receptor ingestion rates, selection of acceptable HQs, estimation of site usage, and estimation of plant uptake factors and bioaccumulation factors. Additional uncertainties are associated with the depiction of site characteristics, the determination of the nature and extent of contamination, and the derivation of Threshold Limit Values. All of these uncertainties likely influence risk.

Overall, it is important to reiterate that it was anticipated that the conservative nature of the ERA at the WAG level would result in many sites and contaminants being indicative of potentially unacceptable risk to ecological receptors. This is due to the exposure calculations using a very conservative approach and is also compounded by the methods used to determine extent of contamination and characterize exposure concentrations at each release site.

Because of these considerations, the relative small size of the sites, and the conservatism of the ecological risk assessment, no significant ecological impact is anticipated from these sites. The need for remedial action at sites posing a potentially unacceptable ecological risk will be reconsidered if the INEEL-wide ecological risk assessment suggests that these conclusions are not well founded.

## 6.3 Groundwater Fate and Transport

WAG 2 includes three potential sources of groundwater contamination: contamination contained in perched water bodies beneath TRA, contamination injected into the aquifer by the TRA-05 disposal well, and contamination that could leach from surface and near-surface soil. From 1964 until 1972, the TRA-05 disposal well was used to dispose of the secondary reactor cooling water. This disposal well injected directly into the SRPA and did not contribute contaminants to the Perched Water System. After 1972, hexavalent chromium was no longer used as a rust inhibitor in the cooling systems and was no longer discharged to the disposal well or to the ponds. Use of the disposal well ceased in 1982. Groundwater contamination produced by perched water system infiltration and disposal well injection was evaluated as part of the OU 2-12 perched water system RI, while contamination that could leach into the SRPA from surface and near surface soil was evaluated using the computer code GWSCREEN in the baseline risk assessment.

As discussed in the OU 2-12 perched water system RI, the principal groundwater COCs at WAG 2 are chromium and tritium (H-3). The Third Annual Technical Memorandum states that the MCLs for chromium and H-3 have been exceeded in various wells throughout the OU 2-12 monitoring. Specifically, the MCL for chromium is 100 μg/L, and the MCL for H-3 is 20 pCi/mL. To date, the monitoring indicates the following about the TRA wells: (a) the long-term concentration trend (1988-present) is decreasing for both contaminants in USGS-55, USGS-56, and USGS-65; (b) the short-term, post-ROD concentration pattern (1993-present) is variable in USGS-55, increasing in USGS-56, and near stable in USGS-65; (c) the concentration trend for chromium is increasing in USGS-53 but decreasing in USGS-64; and (d) the concentration trend for H-3 is decreasing in USGS-53. In addition, there are insufficient TRA-7 data to make contaminant trend determinations.

As discussed in the OU 2-12 ROD, H-3 is expected to fall below MCLs by the year 2004, and chromium is expected to fall below MCLs by the year 2016. So neither contaminant is expected to produce unacceptable risks from groundwater ingestion at WAG 2 if residential development occurs at TRA in 100 years. The radiologically contaminated wastewater source to the Warm Waste Pond has been removed. The groundwater modeling performed for the OU 2-12 RI/FS predicted that the H-3 contamination in the SRPA beneath TRA will naturally be reduced to concentrations that are less than MCLs through radioactive decay and downgradient transport, and that most of the chromium contamination will be reduced via dilution and dispersion.

The groundwater contamination below the TRA commingles with groundwater contamination below the Idaho Chemical Processing Plant (ICPP). The groundwater contamination below the ICPP is being evaluated as part of the OU 3-13 Comprehensive RI/FS. Because of the commingling nature of the plumes below the TRA and ICPP, the chromium and H-3 contamination in the SRPA beneath TRA is being evaluated in the draft OU 3-13 RI/baseline risk assessment. To accomplish this evaluation, the GWSCREEN fluxes derived in the OU 2-13 TRA Groundwater Flow and Contaminant Transport Model were provided for input into the OU 3-13 flow and transport model. The flow and transport model being used for the OU 3-13 baseline risk assessment is TETRAD, a proprietary three dimensional code. The primary time frame of interest for the modeling is 100 years in the future. During this time frame, concentration contours and peak concentrations in the aquifer are calculated for both H-3 and chromium. In addition, the model simulates transport of each contaminant until its peak concentration falls below a concentration equal to the 1E-06 risk concentration or the contaminant's MCL, whichever is lower.

The only other contaminant that is predicted to produce groundwater risks greater than 1E-06 at WAG 2 is arsenic. No remedial action is recommended to lower arsenic groundwater risk because the risk is less than the risk level of 1E-04 that has been agreed to by the agencies as the basis for groundwater remedial action objectives (RAOs), and the predicted concentrations of arsenic are less than the MCL.

## 6.4 Basis for Response

Eight sites within TRA have actual or threatened releases of hazardous substances, which, if not addressed by implementing the response actions selected in this ROD, may present an imminent and substantial endangerment to public health, welfare, or the environment. These sites include four disposal ponds [Warm Waste Pond (TRA-03), Chemical Waste Pond (TRA-06), Cold Waste Pond (TRA-08), and the Sewage Leach Pond (TRA-13)], three subsurface contaminant release sites [Soil Surrounding Hot Waste Tanks at Building 613 (TRA-15), Tanks 1 and 2 at Building 630 (TRA-19), and the Brass Cap Area], and one area of surficial windblown contamination (Sewage Leach Pond Berms and Soil Contamination Area). The response actions selected in this ROD are designed to reduce the potential threats to human health and the environment to acceptable levels.

The ERA for WAG 2 determined that potential risks to ecological receptors exist at 12 sites. Four of these sites (the Warm Waste Pond, Chemical Waste Pond, Cold Waste Pond, and the Sewage Lagoons) are outside the TRA facility fence. Human health risks exceeding allowable levels exist at these sites, and some level of remediation will be required. The TRA-02 Paint Shop Ditch, TRA-04/05 Warm Waste Retention Basin and Sampling Pit, TRA-16 Inactive Radioactive Contaminated Tank at TRA-614, TRA-36 ETR Cooling Tower Basin, and TRA-38 ATR Cooling Tower sites pose only a potential ecological risk. The need for remedial action at sites posing a potentially unacceptable ecological risk will be reconsidered if the INEEL-wide ecological risk assessment suggests that these conclusions are not well founded. Any remedial alternative that reduces human health risks would be expected to also reduce ecological risks. The remaining sites are inside the facility fence, where ongoing facility operations result in limited ecological exposure. The relatively small size of these sites would also likely result in little or no ecological risk. The need for remedial action will be considered if the INEEL-wide ecological risk assessment suggests that these conclusions are not well founded.

# 7. DESCRIPTION OF ALTERNATIVES

## 7.1 Remedial Action Objectives

Remedial action objectives for TRA (OU 2-13) were developed in accordance with the NCP and CERCLA RI/FS guidance. The RAOs were defined through discussions among agencies (IDHW, EPA, and DOE). The RAOs are based on the results of the human health risk assessment and are specific to the COCs and exposure pathways developed for OU 2-13. They are as follows:

For protection of human health

- Inhibit direct exposure to radionuclide COCs that would result in a total excess cancer risk of greater than 1 in 10,000 to 1,000,000 (1E-04 to 1E-06) to current and future workers and future residents.

- Inhibit ingestion of radionuclide and nonradionuclide COCs by all affected exposure routes (including soil and groundwater ingestion, and ingestion of homegrown produce) that would result in a total excess cancer risk of greater than 1 in 10,000 to 1,000,000 (1E-04 to 1E-06) or a hazard index greater than 1 to current and future workers and future residents.

- Inhibit degradation of any low-level soil repository covers (e.g., Warm Waste Pond 1952 and 1957 cell covers) that would result in exposure to buried wastes or migration of contaminants to the surface that would pose a total excess cancer risk (for all contaminants) of greater than 1 in 10,000 to 1,000,000 (1E-04 to 1E-06) or a hazard index greater than 1 to current and future workers and future residents.

For protection of the environment

- Inhibit adverse effects to resident populations of flora and fauna, as determined by the ecological risk evaluation, from soil, surface water, or air containing COCs.

- Inhibit adverse effects to sites where COCs remain in place below ground surface that could result in exposure to COCs or migration of COCs to the surface.

To meet these objectives, preliminary remediation goals (PRGs) were established. These goals are quantitative cleanup levels based primarily on ARARs and risk-based doses. The PRGs are used in remedial action planning and assessment of effectiveness of remedial alternatives. Final remediation goals are based on the results of the baseline risk assessment and evaluation of expected exposures and risks for selected alternatives.

The 1 chance in 10,000 risk (1E-04) or hazard index of 1, whichever is more restrictive for a given contaminant, is the primary basis for determining PRGs for the OU 2-13 sites of concern. The basis for using the upper end of the 1E-04 to 1E-06 is justified based on the remoteness of the site, conservatism of the risk assessments, the absence of current residents, and modeling 100 years in the future for future residents, and as consistent with exposure levels established to be acceptable by EPA for radionuclides. Preliminary remediation goals for individual COCs were defined by calculating soil concentrations that would result in excess cancer risks equal to 1E-04 or hazard indexes equal to 1 for the 100-year future residential exposure scenario due to exposure to all of a site's COCs. For example, if a given site contained only one COC, the PRG basis for the COC was risk equal to 1E-04 and hazard index equal to 1. But if the site contained two COCs, the PRG basis was risk equal to 1E-04 divided by 2 (or 5E-05) and a hazard index equal to 1/2. The primary COCs for WAG 2 are radionuclides. Table 7-1 presents the final remediation goals that have been established for the eight sites of concern in OU 2-13. Remedial actions will ensure that risk is mitigated to the point that exposure would not exceed these levels. On the basis of these remediation goals, areas and volumes of contaminated media that would require some form of remedial action were identified. These estimated areas, depths, and volumes are presented in Table 7-2.

## 7.2 Summary of Alternatives

In accordance with Section 121 of CERCLA, the FS identified alternatives that (a) achieve the stated RAOs, (b) provide overall protection of human health and the environment, (c) meet ARARs, and (d) are cost effective. These alternatives, used individually or in combination, can satisfy the RAOs through reduction of contaminant levels, volume or toxicity, or by isolation of contaminants from potential exposure and migration pathways. For OU 2-13 (TRA) sites, soil is the only medium of concern targeted for remediation. Five alternative categories were identified to meet the RAOs for contaminated soil at OU 2-13 sites:

1. No Action (with monitoring)
2. Limited Action
3. Containment and Institutional Controls
4. Excavation, Treatment, and Disposal
5. Excavation and Disposal.

Estimated present worth costs for the remedial alternatives for all sites are shown in Table 9-2 in Section 9. Post-closure costs were estimated for the full duration of the 100-year period of monitoring.

### 7.2.1 Alternative 1: No Action (With Monitoring)

The NCP [40 CFR 300.430(e)(6)] requires consideration of a No Action alternative to serve as a baseline for evaluation of other remedial alternatives. The No Action (with monitoring) alternative does not involve active remedial actions but environmental monitoring may be warranted if contamination were left in place under this alternative. Monitoring would enable identification of potential contaminant migration within environmental media (air, groundwater, and soil) or other changes in site conditions that may warrant future remedial actions. No land-use restriction, controls, or active remedial measures are implemented at the site. If warranted, monitoring is an institutional action assumed to remain in effect for at least 100 years. For the sites in this ROD, environmental monitoring would consist of radiological surveys in appropriate areas and groundwater monitoring. Air monitoring will be performed as part of the air monitoring program. It is anticipated that monitoring will be conducted at least annually, but the frequency will be determined during the remedial design as well as the appropriate areas.

**Table 7-1.** Final remediation goals for OU 2-13 sites of concern.

| Site | Contaminant of Concern | Final Remediation Goals (mg/kg for nonradionuclides pCi/gm for radionuclides)[a,b,c] |
|---|---|---|
| Warm Waste Pond (TRA-03) | Ag-108m | 0.39 |
| | Cs-137 | 7.78 |
| | Eu-152 | 99.9 |
| Chemical Waste Pond (TRA-06) | Ba | 926 |
| | Mn | 146 |
| | Hg | 0.47 |
| | Zn | 43.3 |
| Cold Waste Pond (TRA-08) | As | 18.3 |
| | Cs-137 | 11.7 |
| Sewage Leach Pond (TRA-13) | Hg | 0.94 |
| | Zn | 86.6 |
| | Ag-108m | 0.58 |
| | Cs-137 | 11.7 |
| Soil surrounding hot waste tanks at Building 613 (TRA-15) | Cs-137 | 23.3 |
| Soil surrounding Tanks 1 and 2 at Building 630 (TRA-19) | Cs-137 | 23.3 |
| Brass Cap Area | Cs-137 | 23.3 |
| Sewage Leach Pond Berm and Soil Contamination Area | Cs-137 | 23.3 |

a. Final remediation goals are soil concentrations of COCs that would result in a cumulative excess cancer risk of 1 in 10,000 or a hazard index greater than 1 for the 100-year residential exposure scenario. These may vary during the actual cleanup in recognition of natural background levels as established in Rood, 1995, and in recognition that cleanup to within the acceptable risk range could be achieved with a different mix of the COCs than was assumed in establishing these final remediation goal (FRG) values.

b. See Section 7.1 for a discussion of the risk basis for these FRGs. These FRGs may be met via installation of a cover to ensure that these levels are not exceeded through an available exposure pathway.

c. This table was generated during the RI/FS process.

**Table 7-2.** Estimated area and volume of contaminated media requiring remedial action.

| Site | Surface Area ($ft^2$) | Depth of Contamination (ft) | Soil Volume[a] ($ft^3$) |
|---|---|---|---|
| **Disposal Pond Sites** | | | |
| Warm Waste Pond (TRA-03) | 5.88E+04 | 1.23E+01 | 7.23E+05 |
| Chemical Waste Pond (TRA-06) | 2.90E+04 | 5.00E-01 | 1.45E+04 |
| Cold Waste Pond (TRA-08) | 1.58E+05 | 5.00E-01 | 7.92E+04 |
| Sewage Leach Pond (TRA-13) | 3.25E+04 | 6.00E+00 | 1.95E+05 |
| **Subsurface Release Sites** | | | |
| Hot Waste Tanks at Building 613 (TRA-15) | 6.24E+02 | 3.83E+01 | 2.39E+04 |
| Tanks 1 and 2 at Building 630 (TRA-19) | 6.00E+01 | 1.00E+01 | 6.00E+02 |
| Brass Cap Area | 2.83E+02 | 1.00E+01 | 2.83E+03 |
| **Windblown Surficial Contamination Site** | | | |
| Sewage Leach Pond Berm and Soil Contamination Area (outside fence) | 2.26E+05 | 5.00E-01 | 1.13E+05 |

a. Estimated soil volume for remediation = 6.24E+03 $ft^3$ based on 10-ft excavation depth.

While the No Action alternative does not involve any construction or operational activities that would result in disturbances to the surfaces of the OU 2-13 sites, IDAPA 16.01.01.650 could nonetheless apply to any sites that were a source of fugitive dust and is, therefore, considered an ARAR that would not be met. If metals and semivolatile organic compounds were present in fugitive dust, then IDAPA 16.01.01.585-586 are ARARs that would not be met. 40 CFR 122.26 would similarly apply, and would not be met. IDAPA 16.01.11.200 would be met by ongoing groundwater monitoring. The No Action alternative would not meet DOE orders because health risks to current workers and potential future residents exceed allowable ranges. The estimated cost for implementing the No Action (with monitoring) alternative is relatively low when compared to the other alternatives and ranges from $2.2M at the Brass Cap site to $3.2M at the Warm Waste Pond.

### 7.2.2 Alternative 2: Limited Action

A Limited Action alternative was developed primarily for those sites posing an unacceptable risk to current and future workers and for which the radionuclide contamination will decay to acceptable levels within the next 100 years. However, this alternative may be implemented in conjunction with a contingent remedial alternative for those sites determined to pose an unacceptable risk and where access is physically limited thereby inhibiting full implementation of the contingent remedy at this time. This alternative essentially continues management practices and institutional controls currently in place at OU 2-13 disposal pond, surficial contaminated soil, and buried contaminated soil sites. Current management practices and institutional controls are in place as a result of Department of Energy responsibilities and authorities for maintaining security, control, and safety at DOE facilities. These responsibilities and authorities have their basis in the Atomic Energy Act of 1954. For DOE facilities, Federal Regulation 10 CFR 835 implements the Radiation Protection Guidance to Federal Agencies for Occupational Workers, recommended by the EPA and issued by the President on January 20, 1987. The requirements of this regulation include standards for control of occupational radiation exposure, control of access to radiological areas, personnel training, and record keeping.

In addition, the regulations specify limits for maintaining occupational radiation exposure as low as reasonably achievable (ALARA), and requires that DOE activities be conducted in compliance with a documented radiation protection program approved by DOE. At INEEL, the requirements of 10 CFR 835 are primarily implemented through DOE Order 5400.5. Regulations for the protection and security of DOE facilities are included in 10 CFR 860, which prohibits unauthorized entry. This regulation is implemented through DOE Order 5632.1C. At the INEEL, the requirements of this order are primarily implemented through DOE's Management and Operating Safeguards and Security manuals. The manuals and associated control procedures define the programs and requirements for protecting INEEL property, personnel, and sensitive information. The manuals include defining the processes for protecting controlled property from theft, intentional acts of destruction and misuse, access controls for employees and offsite visitors to the INEEL, and procedures for conducting investigations or security incidents.

A description of the areas where access will be restricted, the specific controls (e.g., fences, signs) that will be used to ensure that access will be restricted, the types of activities that will be prohibited in certain areas (e.g., excavation), and the anticipated duration of such controls will be placed in the "INEEL Comprehensive Facility and Land Use Plan" maintained by the Office of Program Execution. DOE shall also provide the Bureau of Land Management the detailed description of controls identified above. This information will be submitted to the EPA and IDHW once it has been placed in the INEEL Comprehensive Facility and Land Use Plan.

DOE-ID will submit a written evaluation of the effectiveness of the institutional controls at the TRA as part of every 5-year review. This report, at a minimum, will include a description of a walk-through of the areas subject to institutional controls conducted at the time of each 5-year review.

Short-term effectiveness of this alternative is considered high, as this alternative is already implemented at the sites. Radiation control area fences and signs are maintained. No specialized equipment, personnel, or services are required to continue to implement the Limited Action alternative. Implementation of this alternative would have no physical effect or habitat alteration on the environment beyond what is already there.

The estimated costs for implementing the Limited Action alternative are described in Sections 8 and 9 of this ROD.

### 7.2.3 Alternatives 3a and 3b: Containment Alternatives and Institutional Controls

The two containment alternatives consist of the isolation of contaminated soil from potential receptors (for the period of time that unacceptable cumulative exposure risks will be present) through the use of a protective cover followed by institutional controls, including long-term environmental monitoring, [as described above for the No Action (with monitoring) alternative] cover integrity monitoring and maintenance, access restrictions, and surface water diversion. Institutional controls are assumed to remain in effect for at least 100 years. These alternatives were considered for the Waste Disposal Ponds and Subsurface Release Sites at TRA.

Alternative 3a consists of an engineered cover originally developed by the Uranium Mill Tailings Remedial Action program for stabilization of abandoned uranium mill tailings. This design, based on recent biointrusion research studies at the INEEL, was recently constructed at the INEEL stationary Low-Power Reactor-I burial ground site (Figure 7-1). This cover

- Requires minimal maintenance
- Inhibits inadvertent human intrusion
- Minimizes plant and animal intrusion
- Inhibits contaminant migration.

The cover design consists of four layers of natural geologic materials, with the uppermost layer consisting of rock riprap to inhibit intrusion and minimize erosion, a second layer of gravel overlying a third layer of riprap or cobbles, and a fourth layer consisting of gravel. Deviation from this sequence of materials and respective material thicknesses is not anticipated; however, the engineered cover design may be refined during the remedial design phase.

Alternative 3b consists of a native soil cover. This cover consists of a 10-ft (3-m) single layer of lower permeability soil obtained on the INEEL, applied in lifts and compacted to 95% of optimum moisture and density (see Figure 7-1). The surface would be completed to promote runoff and may be vegetated with a crested wheatgrass mixture that does not require supplemental water or nutrients once established, or a gravel mulch/rock armor material to be determined during remedial design. Specific design elements for the native soil cover will be developed during the remedial design phase.

Each capping technology is designed to prevent direct radiation exposures, resist erosion because of wind and surface water runoff, and resist biointrusion that may penetrate the contamination zone or facilitate erosion. The primary differences between capping technologies are the length of time these functions can be maintained and the effectiveness of the biointrusion and erosion control components of the designs. The design life of the capping technologies specified for the containment alternatives will depend on the construction materials specified, number and thickness of layers required, and sequence of those layers. The long-term effectiveness and permanence required at the Warm Waste Pond and the Sewage Leach Pond is at least the decay time required to reduce external exposure risks to acceptable levels. The engineered barrier design is likely to provide a higher level of protection against biointrusion. Thick soil will eliminate intrusion into waste by most INEEL species, but not all plants and invertebrates. Root intrusion into contaminated soils could result in mobilization of radionuclides to environmental

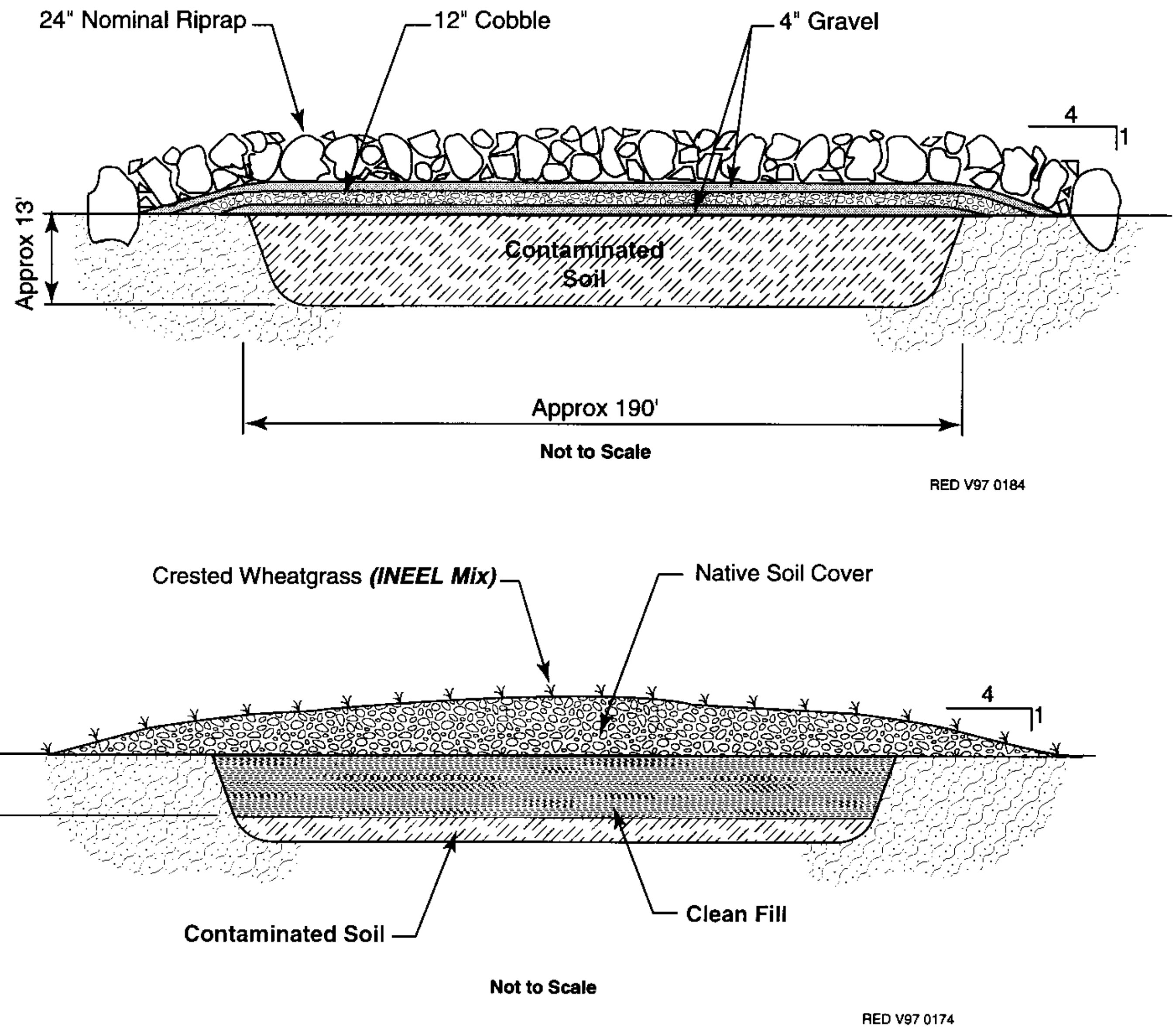


**Figure 7-1**. Cross-sectional schematic typical of the engineered cover and the native soil cover.

receptors. The engineered barrier is also likely to provide more effective control of wind erosion. Vegetated surfaces are erosion resistant, but fire and other natural and human activities, including grazing, could reduce or eliminate vegetation and allow wind erosion to occur.

Environmental impacts resulting from the excavation and construction activities would be minimal. Materials would be excavated, transported, and placed entirely within previously disturbed areas. Installation of surface water diversion controls at the OU 2-13 disposal pond sites might result in alteration of the nearby terrain. However, the overall impact of these activities is not considered irreparable and would be unnoticeable in the long run. The remoteness of the site would prevent any impact to the surrounding communities during construction activities. No environmentally sensitive areas such as archaeological or historical sites, wetlands, or critical habitat exist in the vicinity of the OU 2-13 sites, because all are in previously disturbed areas.

Costs associated with the cover alternatives at each site are detailed in Sections 8 and 9 of this ROD.

### 7.2.4 Alternative 4: Excavation, Treatment, and Disposal

Standard treatment technologies have not been shown to be effective for the radionuclide-contaminated soils at INEEL. Based on previous INEEL studies, no technology or combination of technologies has been demonstrated to be able to achieve significant volume reduction of radionuclide-contaminated TRA soils and sediments, primarily because of the binding of cesium in both surface microfissures of large-grained soil fractions, and in the silicate lattices of clay materials of fine grained fractions.

Technologies evaluated include physical separation using screening, flotation, attrition scrubbing, monitor and gate systems, soil washing, chemical stabilization, and thermal treatment using plasma torch. Therefore, this alternative was identified as being potentially applicable only to the sediments of the Chemical Waste Pond (TRA-06) that are contaminated with mercury. Under this alternative, those sediments with mercury concentrations exceeding 260 ppm would be excavated and treated with a mercury retort process. These sediments would be heated, volatilizing mercury as a vapor. The vapor would be subsequently cooled, and the liquid mercury would be recovered for recycling and disposal. Equipment would include a feed conveyor, heating units, heat exchangers, condensers, and air pollution control equipment, including a baghouse and granular activated carbon absorbers. This alternative would achieve long-term effectiveness because of the expected reduction in contaminant mobility, volume, and toxicity of the treated sediments.

Implementation of the mercury retort process is dependent on mercury contamination being present at concentrations exceeding 260 ppm and whether the mercury is in an elemental or ionized state. During the remedial design phase, further consideration may also be given to other potentially appropriate treatment process options identified in the OU 2-13 comprehensive RI/FS such as stabilization of mercury-contaminated soils. The determination as to whether this treatment technology is appropriate or not will be dependent upon post-ROD sampling of the Chemical Waste Pond. The goals of the post-ROD sampling will be to determine the nature and extent of contamination at the Chemical Waste Pond, although it is anticipated that mercury will be the primary focus of the sampling effort. The costs associated with excavation, treatment, and disposal are estimated in Section 8 and 9 of this ROD.

### 7.2.5 Alternative 5: Excavation and Disposal

This alternative involves complete removal of material contaminated at unacceptable concentration levels from a human health perspective, to levels of intrusion (maximum of 10 ft) or to the maximum depth at which contaminant concentrations exceed preliminary remediation goals, whichever is less. This would be followed by offsite transportation and disposal at a disposal facility licensed to receive low-level radioactively contaminated soils. Verification samples would be collected to ensure that the final remediation goals were met.

The license for a disposal facility will specify the radionuclide activity levels that can be accepted. Transportation would involve a combination of onsite trucking to a railhead and offsite rail transportation to the disposal facility.

This alternative provides long-term effectiveness because the contamination would be removed from the site. Long-term monitoring would no longer be required, assuming removal of contaminated soils achieve acceptable levels. Costs of excavation and disposal, which are high compared to other alternatives considered, can be found in greater detail in Sections 8 and 9 of this ROD.

## 7.3 Summary of Comparative Analysis of Alternatives

The five alternatives discussed in Section 7.2 were evaluated using the nine evaluation criteria as specified by CERCLA:

1. *Overall protection of human health and the environment*—addresses whether a remedy provides adequate protection of human health and the environment, and describes how risks posed through each exposure pathway are eliminated, reduced, or controlled through treatment, engineering controls, or institutional controls.

2. *Compliance with ARARs*—addresses whether a remedy will meet all of the ARARs under federal and state environmental laws and/or justifies a waiver.

3. *Long-term effectiveness and permanence*—refers to expected residual risk and the ability of a remedy to maintain reliable protection of human health and the environment over time, once cleanup goals have been met.

4. *Reduction of toxicity, mobility, or volume through treatment*—addresses the degree to which a remedy employs recycling or treatment that reduces the toxicity, mobility, or volume of the COCs, including how treatment is used to address the principal risks posed by the site.

5. *Short-term effectiveness*—addresses any adverse impacts on human health and the environment that may be posed during the construction and implementation period, and the period of time needed to achieve cleanup goals.

6. *Implementability*— addresses the technical and administrative feasibility of a remedy, including the availability of materials and services needed to implement a particular option.

7. *Cost*—includes estimated capital and operation costs, expressed as net present-worth costs.

8. *State acceptance*—reflects aspects of the preferred alternative and other alternatives that the state favors or objects to, and any specific comments regarding state ARARs or the proposed use of waivers.

9. *Community acceptance*—summarizes the public's general response to the alternatives described in the Proposed Plan and in the RI/FS, based on public comments received.

Table 7-3 presents the results of the comparative analysis of the five alternatives using a ranking based on an alternative's ability to meet the nine evaluation criteria. Table 7-4 provides a ranking of alternatives for each on the basis of the comparative analysis. The following sections describe how each alternative either does or does not meet the criteria.

Each of the five alternatives subjected to the detailed analysis was evaluated against the nine evaluation criteria identified under CERCLA. The criteria are subdivided into three categories: (1) threshold criteria that mandate overall protection of human health and the environment and compliance with ARARs; (2) primary balancing criteria that include long- and short-term effectiveness, implementability, reduction in toxicity, mobility or volume through treatment, and cost; and (3) modifying criteria that measure the acceptability of alternatives to state agencies and the community. The following sections summarize the evaluation of the five alternatives against the nine evaluation criteria.

### 7.3.1 Threshold Criteria

The remedial alternatives were evaluated in relation to the two threshold criteria: overall protection of human health and the environment, and compliance with ARARs. The selected remedial action must meet the threshold criteria. Although the No Action alternative does not meet the threshold criteria, this alternative was used in the detailed analysis as a baseline against which the other alternatives were compared, as directed by EPA guidance.

**7.3.1.1 Overall Protection of Human Health and the Environment.** This criterion addresses whether a remedy provides adequate protection of human health and the environment and describes how risks posed through each exposure pathway are eliminated, reduced, or controlled through treatment, engineering controls, or institutional controls.

Alternative 1 (No Action With Monitoring) would not satisfy the criterion of overall protection of human health and the environment because access to the site and contact with the waste are not prevented. Alternative 2 (Limited Action) would be effective for protecting human health and the environment. Institutional controls, including access restrictions, are regarded as reliable for at least 100 years following site closure. With the exception of mercury at the Chemical Waste Pond, COCs were determined to degrade to risk levels less than 1E-04 within 100 years. Therefore, no long-term human health risks will exist after that time. Institutional controls at the Chemical Waste Pond would have to be maintained permanently as the COC, mercury, does not degrade.

Regarding both the engineered barrier (Alternative 3a), and the native soil cover (Alternative 3b), each containment alternative involves the use of institutional controls (radiation surveys, cap integrity monitoring, and access restrictions) and surface water diversion controls. Surface water diversion controls will be maintained at least until the 100-year institutional control period expires. Alternative 3a (engineered barrier) is expected to be highly protective of human health and the environment for at least

**Table 7-3**. Comparative analysis summary of remedial alternatives for OU 2-13 sites of concern.

| Criteria | Alternative 1 No Action (with monitoring) | Alternative 2 Limited Action | Alternative 3a Containment w/ Engineered Cover | Alternative 3b Containment w/Native Soil Cover | Alternative 4 Excavation, Treatment, and Disposal | Alternative 5 Excavation and Disposal |
|---|---|---|---|---|---|---|
| Overall Protection of Human Health and the Environment | | | | | | |
| Human Health Protection | Risks are not reduced. | Is effective for duration of risk. | Inhibits direct exposure to contaminated soil for duration of unacceptable risk. Minimal exposure risk during cover construction. | Inhibits direct exposure to contaminated soil for duration of unacceptable risk. Minimal exposure risks during cover construction. Less resistance to erosion than engineered cover. Less effective than engineered cover for inhibiting biointrusion. | Eliminates potential exposure from contaminated soil at site. Protectiveness is based on completely removing contamination from the site. Short-term risk is moderate due to direct exposure during excavation. | Eliminates potential exposure from contaminated soil at site. Protectiveness is based completely on removing contamination from the site. Short-term risk is moderate due to direct exposure during excavation. |
| Environmental Protection | Allows migration of contaminated surface soil by wind and surface water erosion and provides little protection from exposure. | Risk reduction achieved. | Provides effective protection for duration of unacceptable risk. Minimal environmental impacts during construction. Inhibits intrusion by burrowing mammals and deep-rooted plants. | Provides moderate protection for duration of unacceptable risk. However, biointrusion into contaminated soils may result in exposure to contaminants. Minimal environmental impacts during construction. | Eliminates contamination from site and is therefore highly protective. | Eliminates contamination from the site and is therefore highly protective. |
| Compliance with ARARs | | | | | | |
| Action-specific | Would not meet ARARs for fugitive dust emissions. | Meets ARARs for period of time when management and institutional controls in place. | Meets ARARs | Meets ARARs | Meets ARARs | Meets ARARs |
| Location-specific | Would not meet ARARs for control of stormwater discharge. | Meets ARARs for period of time when management and institutional controls in place. | Meets ARARs | Meets ARARs | Meets ARARs | Meets ARARs |

**Table 7-3**. (continued).

| Criteria | Alternative 1 No Action (with monitoring) | Alternative 2 Limited Action | Alternative 3a Containment w/ Engineered Cover | Alternative 3b Containment w/Native Soil Cover | Alternative 4 Excavation, Treatment, and Disposal | Alternative 5 Excavation and Disposal |
|---|---|---|---|---|---|---|
| Chemical-specific | Would not meet ARARs for groundwater protection standards and groundwater quality rules. | Meets ARARs for period of time when management and institutional controls in place. | Meets ARARs | Meets ARARs | Meets ARARs | Meets ARARs |
| To be considered | Would not satisfy DOE orders (i.e., radiation protection standards). | Satisfies DOE orders | Satisfies DOE orders | Satisfies DOE orders | Satisfies DOE orders | Satisfies DOE orders |
| Long-Term Effectiveness and Permanence | | | | | | |
| Magnitude of residual risk | No change from existing risk | Source-to-receptor pathways eliminated while management and institutional controls remain in place. | Source-to-receptor pathways eliminated while cover remains in place. | Source-to-receptor pathways eliminated while cover remains in place. | No residual risk would remain at site as long as residuals <final remediation goals | No residual risk would remain at site. |
| Adequacy and reliability of controls | No control and, therefore, no reliability. | Effective for period of time when management and institutional controls in place (at least 100 years). | Limited access to contaminated soil and institutional controls effective at least 100 years. Barrier effective for duration of unacceptable risk. | Limited access to contaminated soil and institutional controls effective at least 100 years. Barrier effective for duration of unacceptable risk. | Effective provided mercury at TRA-06 is properly recycled. | Effective provided disposal facility provides adequate control over contaminated soil and sediment following excavation from the site. |
| Reduction of Toxicity, Mobility, or Volume through Treatment | | | | | | |
| — | Not applicable | Not applicable | Not applicable | Not applicable | Greater than 90% of mercury recovered, volume of contaminated soil reduced by over 90%, mercury recovered and recycled, meets preference for treatment for those soils treated; not all soils will necessarily be treated. | Not applicable |

**Table 7-3**. (continued).

| Criteria | Alternative 1 No Action (with monitoring) | Alternative 2 Limited Action | Alternative 3a Containment w/ Engineered Cover | Alternative 3b Containment w/Native Soil Cover | Alternative 4 Excavation, Treatment, and Disposal | Alternative 5 Excavation and Disposal |
|---|---|---|---|---|---|---|
| | | | Short-Term Effectiveness | | | |
| Community protection | No increase in potential risks to the public. | No increase in potential risks to the public. | Minimal increase in potential risks to the public. | Minimal increase in potential risks to the public. | Slight increase in potential risks to the public if offsite transport of contaminants occurs. | Slight increase in potential risks to the public if offsite transport of contaminants occurs. |
| Worker Protection | Workers not protected, assuming existing administrative and institutional controls not in place. | Workers are protected by administrative and institutional controls. | Worker risk during barrier installation is minor because existing clean soil surface layers afford shielding. | Worker risk during barrier installation is minor because existing clean soil surface layers and installation of lowermost layer(s) afford shielding. | Worker risk from exposure to contaminated soil and sediment will require administrative/ engineering controls and excavation equipment modified for use in radioactively contaminated environments. | Worker risk from exposure to contaminated soil and sediment will require administrative/ engineering controls and excavation equipment modified for use in radioactively contaminated environments. |
| Environmental Impacts | Existing conditions are not impacted. | Existing conditions are not impacted. | Impacts would be limited to disturbances from vehicle and material transport activities associated with barrier construction. Limited potential for airborne contamination in the form of fugitive dust, because water sprays are used. | Impacts would be limited to disturbances from vehicle and material transport activities associated with barrier construction. Water sprays would be used to limit the potential for airborne contamination in the form of fugitive dust. | Impacts would be limited to disturbances from vehicle and material transport activities associated with barrier construction. Limited potential for airborne contamination in the form of fugitive dust, because water sprays are used. | Impacts would be limited to disturbances from vehicle and material transport activities associated with barrier construction. Limited potential for airborne contamination in the form of fugitive dust because water sprays are used. |
| | | | Implementability | | | |
| Time until action is complete | Not applicable | Currently implemented. | Will require approximately 12 to 15 months to complete action. | Will require approximately 12 to 15 months to complete action. | Will require approximately 18 to 24 months to complete action. | Will require approximately 12 to 15 months to complete action. |

**Table 7-3.** (continued).

| Criteria | Alternative 1 No Action (with monitoring) | Alternative 2 Limited Action | Alternative 3a Containment w/ Engineered Cover | Alternative 3b Containment w/Native Soil Cover | Alternative 4 Excavation, Treatment, and Disposal | Alternative 5 Excavation and Disposal |
|---|---|---|---|---|---|---|
| Ability to construct and operate | Not applicable | Currently implemented. | Involves available construction technology. | Involves available construction technology. | Difficult, involves available excavation and processing technology. | Somewhat difficult due to safety requirements. |
| Ease of implementing additional action if necessary | Feasibility study/record of decision process may need to be repeated. | Easily implemented. | Additional remedial actions would be difficult because the barrier is intended to prevent access to contamination. Therefore, the barrier would require removal. | Additional remedial actions would be difficult because the barrier is intended to prevent access to contamination. Therefore, the barrier would require removal. | Additional remedial action would not be necessary because all contaminated soil and sediment are removed. | Additional remedial action would not be necessary because all contaminated soil and debris are removed. |
| Ability to monitor effectiveness | Monitoring of conditions is readily implemented. | Monitoring of conditions is readily implemented. | Barrier performance can be monitored through radiation surveys; physical integrity can be visually assessed. | Barrier performance can be monitored through radiation surveys; physical integrity can be visually assessed. | The effectiveness in removing and treating all RCRA-hazardous contaminated materials associated with the site is easily determined. | The effectiveness in removing all contaminated materials associated with the site is easily monitored. |
| Ability to obtain approvals and coordinate with regulatory agencies | No approvals required. | No approvals required. | No difficulties identified. | No difficulties identified. | Difficult due to potential requirements for environmental assessments, safety analyses, and ARARs compliance. | Difficult due to potential requirements for environmental assessments, safety analyses, and ARARs compliance. |
| Availability of services and capacity | None required. | None required. | Barrier design and services exist within the DOE and are considered readily available to the INEEL. | Barrier design and services exist within the DOE and are considered readily available to the INEEL. | Services available either onsite or through subcontractor, recycling facility assumed available based on prior INEEL actions. | Services available either onsite or through subcontractor. |

**Table 7-3.** (continued).

| Criteria | Alternative 1 No Action (with monitoring) | Alternative 2 Limited Action | Alternative 3a Containment w/ Engineered Cover | Alternative 3b Containment w/Native Soil Cover | Alternative 4 Excavation, Treatment, and Disposal | Alternative 5 Excavation and Disposal |
|---|---|---|---|---|---|---|
| Availability of equipment, specialists, and materials | None required. | None required. | Equipment and materials are readily available at the INEEL or within the surrounding communities. | Equipment and materials are readily available at the INEEL or within the surrounding communities. | Equipment and materials are either available onsite or through subcontractors. | Equipment and materials are either available onsite, through subcontractors, or will be purchased. Trained specialists are available within the communities surrounding the INEEL. |
| Implementability of institutional controls | None required. | Easily accomplished because operational controls currently in place | Easily accomplished because operational controls currently in place. Materials and services exist at the INEEL to invoke additional controls if necessary. | Easily accomplished because operational controls currently in place. Materials and services exist at the INEEL to invoke additional controls if necessary. | Easily accomplished because operational controls currently in place. Materials and services exist at the INEEL to invoke additional controls if necessary. | None required |
| Availability of technology | None required. | None required. | Technology is readily available at the INEEL. | Technology is readily available at the INEEL. | Technology is available through subcontractors. | Readily available at the INEEL. |
| Costs | See Table 9-2 | See Table 9-2 | See Table 9-2 | See Table 9-2 | See Table 9-2 | See Table 9-2 |

**Table 7-4**. Relative ranking of alternatives evaluated for the eight OU 2-13 sites of concern.

| Evaluation Criteria | Warm Waste Pond (TRA-03) | Chemical Waste Pond (TRA-06) | Cold Waste Pond (TRA-08) | Sewage Leach Pond (TRA-13) | Soil Surrounding Hot Waste Tanks at Building 613 (TRA-15) | Soil Surrounding Tanks 1 and 2 at Building 630 (TRA-19) | Brass Cap Area | Sewage Leach Pond Berm and Soil Contamination Area |
|---|---|---|---|---|---|---|---|---|
| Overall protection of human health and the environment | 5, 3a, 3b, 1 | 5, 4, 3a, 3b, 1 | 5, 3a, 3b, 1 | 5, 3a, 3b, 1 | 5, 2, 3a, 1 | 5, 3a, 1 | 5, 3a, 1 | 5, 2, 1 |
| Compliance with ARARs | 3a, 3b, 5 | 4, 3a, 3b, 5, | 3a, 3b, 5 | 3a, 3b, 5 | 2, 3a, 5 | 3a, 5 | 3a, 5 | 2, 5 |
| Long-term effectiveness and permanence | 5, 3a, 3b, 1 | 4, 5, 3a, 3b, 1 | 5, 3a, 3b, 1 | 5, 3a, 3b, 1 | 2, 5, 3a, 1 | 5, 3a, 1 | 5, 3a, 1 | 5, 2, 1 |
| Reduction of toxicity, mobility, or volume through treatment | N/A | 4 | N/A | N/A | N/A | N/A | N/A | N/A |
| Short-term effectiveness | 1, 3b, 3a, 5 | 1, 3b, 3a, 5, 4 | 1, 3b, 3a, 5, | 1, 3b, 3a, 5 | 1, 2, 3a, 5 | 1, 3a, 5 | 1, 3a, 5 | 1, 2, 5 |
| Implementability | 1, 3b, 3a, 5 | 1, 3b, 3a, 5, 4 | 1, 3b, 3a, 5 | 1, 3b, 3a, 5 | 1, 2, 3a, 5 | 1, 3a, 5 | 1, 3a, 5 | 1, 2, 5 |
| Cost | 1, 3a, 3b, 5 | 5, 1, 3b, 3a , 4 | 5, 1, 3b, 3a | 1, 3b, 3a, 5 | 1, 2, 3a, 5 | 5, 1, 3a | 5, 1, 3a | 1, 5, 2 |

Note: The order of the listed alternatives, for each site of concern, is the relative ranking from best to worst in meeting the CERCLA evaluation criteria (e.g., when considering the Warm Waste Pond, for "Overall protection of human health and the environment" the highest ranked alternative is "containment with an engineered cover" (3a), and the lowest ranked alternative is "No Action" (1).

Alternative 1 = No Action
Alternative 2 = Limited Action
Alternative 3a = Containment w/engineered cover
Alternative 3b = Containment w/native soil cover
Alternative 4 = Excavation, treatment (mercury retort) and disposal
Alternative 5 = Excavation and Disposal

the length of time an unacceptable risk is posed at the OU 2-13 buried soil and disposal sites. The engineered cover ensures long-term protection because it uses natural construction materials approximately 4 ft thick. Functional requirements of this cover would include inhibiting human and biotic intrusion, as well as meeting other RAOs. The thickness of this barrier would be more than sufficient to shield against penetrating radiation above background levels. Furthermore, this barrier would be designed to inhibit inadvertent human intrusion, and resist erosion from wind and surface water runoff. This barrier would also inhibit biotic intrusion, thereby controlling exposure pathways to environmental receptors. The native soil cover (Alternative 3b) is designed for long-term isolation of waste with minimal maintenance requirements. The cover surface would provide erosion control, and the cover soil thickness would inhibit biointrusion into contaminated soil. However, the potential would exist for deep-rooting vegetation or burrowing invertebrates to mobilize radionuclides into the environment.

Alternative 4 (excavation, treatment, and disposal) involves excavation of mercury-contaminated soils and pond sediments at the Chemical Waste Pond, treatment in a mercury retort, and return of clean soils to the disposal pond. For the purposes of this evaluation, it is assumed that all pond sediments would fail the TCLP and require treatment. This alternative provides highly effective, long-term protection of human health and the environment. The removal of all mercury-contaminated soils from the Chemical Waste Pond would eliminate potential long-term human health and environmental concerns associated with future exposure of mercury migration from the pond. Recycling and/or reuse by an approved and permitted industrial facility is assumed to ensure complete elimination of risks to human health and the environment at this site.

Finally, excavation and disposal (alternative 5) provides highly effective, long-term protection of human health and the environment. The removal of all contaminated soil from OU 2-13 sites of concern would eliminate potential long-term human health and environmental concerns associated with future exposure of contaminant migration from uncontrolled radioactive waste disposal sites. This alternative is also environmentally protective during implementation, based on the contamination mitigation activities that would be used to prevent contaminant migration during excavation activities. However, short-term protection of human health is less effective because workers would receive direct exposure to contaminated soil and debris during excavation.

**7.3.1.2 Compliance with Applicable or Relevant and Appropriate Requirements.** While the No Action alternative does not involve any construction or operational activities that would result in disturbances to the surfaces of the OU 2-13 sites, most ARARs and To Be Considered (TBC) requirements for the eight sites identified as having unacceptable risks or adverse noncarcinogenic health effects would not be met under this alternative. Table 7-3 shows which ARARs would not be met under this alternative. Most ARARs and TBCs would be met under the Limited Action alternative, with the exception of Idaho Fugitive Dust Emission (IDAPA 16.01.01.650 et seq) requirements and Storm Water Discharge regulations (40 CFR 122.26). While the Limited Action alternative does not involve any construction or operational activities that would result in disturbances to the surfaces of the OU 2-13 sites, IDAPA 16.01.01.650 could nonetheless apply to the existing Warm Waste Pond cells if they were a source of fugitive dust and is, therefore, considered an ARAR that would not be met. The ARARs pertaining to current workers are met through administrative controls in place at TRA; these controls would remain in effect during the institutional period (at least 100 years). If metals and SVOCs were present in fugitive dust, then IDAPA 16.01.01.585-586 are ARARs that would not be met.

All ARARs and TBCs would be met under the containment alternatives (Alternatives 3a and 3b). Containment actions, including the use of institutional controls, would reduce the external exposure risk associated with contaminated soil left in place at disposal ponds and subsurface release sites. Alternative 4 involves excavation, treatment, and disposal at the Chemical Waste Pond (TRA-06) only. This alternative satisfies all ARARs and TBCs, provided proper engineering controls (i.e., dust suppression and retort emissions control) are followed during excavation and treatment. Excavation and disposal (Alternative 5) would comply with all ARARs and TBCs. Compliance with the emissions control ARARs would be ensured by performing excavation using water sprays and other techniques for dust suppression, as needed.

Recent investigations have determined that RCRA-listed waste may have been present in the TRA warm and hot waste systems when leaks from the systems to the environment occurred. Therefore, soils at those sites associated with releases from the warm and hot waste systems will be managed in a manner consistent with the hazardous waste determination to be performed at the time of the remedial action.

### 7.3.2 Balancing Criteria

Once an alternative satisfies the threshold criteria, five balancing criteria are used to evaluate other aspects of the remedial alternatives and weigh major tradeoffs among alternatives. The balancing criteria are used in refining the selection of the candidate alternatives for the site. The balancing criteria are: (1) long-term effectiveness and permanence; (2) reduction in toxicity, mobility, or volume through treatment; (3) short-term effectiveness; (4) implementability; and (5) cost.

**7.3.2.1 Long-Term Effectiveness and Permanence.** This criterion evaluates the long-term effectiveness of alternatives in maintaining protection of human health and the environment after remedial action objectives have been met.

Alternative 1 (No Action With Monitoring) provides the least possible level of long-term effectiveness and permanence because unacceptable risks would remain at the sites. The long-term effectiveness and permanence of the Limited Action alternative (Alternative 2) is considered high as long as administrative and institutional controls are in place to prevent human exposure to contaminated surface soil. Alternatives 3a and 3b (containment alternatives and institutional controls) involve the installation of either an engineered barrier or a native soil cover. Cap integrity monitoring and survey programs would be implemented annually for the first 5 years following completion of the cap, and additional monitoring requirements would be evaluated during subsequent 5-year reviews. Therefore, the long-term effectiveness and permanence requirements are met by these alternatives. Each capping technology is designed to resist erosion because of wind and surface water runoff and to resist biointrusion into the contaminated soil. The design of the engineered cover provides greater permanence and lower maintenance. The native soil cover would be more susceptible to erosion and biointrusion and would require more maintenance and monitoring than the engineered cover. Based on direct exposure reduction requirements, the Warm Waste Pond 1952 and 1957 cells would require long-term effectiveness and permanence for a period of at least 270 years. Both containment designs would meet this requirement.

Alternative 4 (excavation, treatment, and disposal) at the Chemical Waste Pond has a high potential for achieving long-term effectiveness and permanence because soil contaminated greater than TCLP levels is completely removed, treated, and used as clean backfill in the excavation. Alternative 5 (excavation and disposal) has the highest potential for achieving long-term effectiveness and permanence because contaminated soil is completely removed from the site. This would reduce or eliminate the need for long-term monitoring and maintenance and would likely eliminate the need for other institutional controls such as fencing and deed restrictions.

**7.3.2.2 Reduction of Toxicity, Mobility, or Volume Through Treatment.** This criterion addresses the statutory preference for selecting remedial actions that employ treatment technologies that permanently reduce toxicity, mobility, or volume of the hazardous substances as their principal elements. Treatment to reduce the toxicity of radionuclides is presently not feasible. Therefore, none of the remedial alternatives, with the exception of excavation, treatment, and disposal of mercury contaminated soil at the Chemical Waste Pond, involves the use of treatment to reduce the toxicity, mobility, or volume of contaminated materials. At the Chemical Waste Pond, it is expected that treatment would reduce the toxicity, mobility, and volume to acceptable levels, if treatment were deemed necessary.

**7.3.2.3 Short-Term Effectiveness.** Short-term effectiveness addresses the time needed to implement remediation methods to reduce any adverse impacts on human health and the environment that may be posed during the construction and implementation period until cleanup goals are achieved.

The short-term effectiveness for any remedial action taken at the TRA would be enhanced to the maximum extent practicable through adherence to strict health and safety protocols for worker protection and use of engineering controls to prevent potential contaminant migration. However, the alternative that provides the least amount of disturbance to contaminated materials ranks the highest in terms of short-term effectiveness. As such, Alternative 1 (No Action With Monitoring) provides the highest degree of short-term effectiveness because no additional onsite activities are required. The Limited Action (Alternative 2) alternative is already implemented at TRA through radiation control and fences, signs, and radiation monitoring; as a result, short-term effectiveness is considered high. No specialized equipment, personnel, or services are required to continue this alternative. Natural decay of radionuclides over time would reduce the environmental and human health risk. Short-term effectiveness criteria for the containment alternatives (Alternatives 3a and 3b) are met because exposure to construction workers during installation of the cover would be minimized. Inhalation and ingestion risks would be minimized by the use of appropriate protective equipment, engineering controls, and adherence to health and safety protocol, including the DOE as-low-as-reasonably-achievable approach to radiation protection.

Risks from transportation would be low because of the likelihood of obtaining construction materials from local sources. Environmental impacts during construction activities would be minimal. The activities would occur within previously disturbed areas. The remoteness of the TRA site would prevent any impact to surrounding communities during construction activities. Short-term effectiveness of Alternative 4 (excavation, treatment, and disposal) at the Chemical Waste Pond is considered relatively high provided administrative and engineering controls are properly conducted. Equipment-operator exposures would be minimized to the extent practicable. Environmental impacts for this alternative are minimal and are similar to those for the excavation and disposal alternative. The RAOs would be achieved by this alternative once excavation, treatment, and disposal of treated soil is complete. Alternative 5 (excavation and disposal) offers the least short-term effectiveness because of direct contact with contaminated materials during excavation and transportation of the disposal facility. However, radiation controls and monitoring would be implemented to mitigate these risks.

Equipment-operator exposures would be minimized to the extent practicable through shielding, use of supplied air, air filters, and other engineering controls (i.e., dust suppression). In addition, exposure could be reduced through reduction in the amount of time spent at the site by any one worker. Some environmental disturbance is likely to occur in the area surrounding the excavation and haulage route. However, these impacts would be temporary and restoration of disturbed areas would occur following completion of construction activities. The RAOs would be achieved by this alternative once excavation and disposal are complete.

**7.3.2.4 Implementability.** The implementability criterion has the following three factors requiring evaluation: (1) technical feasibility, (2) administrative feasibility, and (3) the availability of services and materials. Technical feasibility requires an evaluation of the ability to construct and operate the technology, the reliability of the technology, the ease of undertaking additional remedial action (if necessary), and monitoring considerations. The ability to coordinate actions with other agencies is one factor for evaluating administrative feasibility, and the agencies have demonstrated this ability throughout the project to date. Other administrative activities that would be readily implementable include planning, use of administrative controls, and personnel training. In terms of services and materials, an evaluation of the following availability factors is required: necessary equipment and personnel, prospective technologies, and cover materials.

Alternative 1 (No Action With Monitoring) is the simplest remedial action to implement from a technical perspective because environmental monitoring is all that may be required. If required, monitoring would be performed until future reviews of the remedial action indicate that such activities are no longer necessary. Environmental monitoring services and equipment are readily available. However, Alternative 1 is administratively unacceptable because of the potential risks to human health and the environment posed by the TRA sites of concern. Implementability for Alternative 2 (Limited Action) is high because most administrative and institutional controls are already in place and access to contaminants is currently restricted. The containment alternatives (Alternatives 3a and 3b) are readily implementable based on local sources of materials, conventional construction equipment and methods, and easily implemented institutional controls, including long-term monitoring, cap integrity monitoring, access restrictions and surface water runoff control. Long-term activities following cover construction would include radiation surveys, annual review of cover integrity, institutional controls for 5 years, and subsequent 5-year reviews. Containment activities have been successfully implemented in other areas of the INEEL. At the Chemical Waste Pond, Alternative 4 (excavation, treatment, and disposal) is readily implementable.

Treatment of mercury-contaminated soils has been previously demonstrated to be effective at the INEEL and at identified industrial facilities willing to take recovered mercury. Alternative 5 (excavation and disposal) would be moderately difficult to implement because of the complexity of the retrieval system with respect to safety considerations and containment requirements. Significant effort would be required to perform environmental assessments, safety analyses, and equipment modifications (for operator safety), as well as system testing and demonstration. Although the equipment and technology are available to perform the activities specified in this alternative, increased risks to workers during excavation result in lower implementability relative to other alternatives.

**7.3.2.5 Cost.** In evaluating project costs, an estimation of the direct and indirect costs in present worth dollars is required. Present worth costs are estimated assuming variable annual inflation factors for the first 10 years, and a constant 5% annual inflation rate after that. A constant 5% discount rate is assumed. Direct costs include the estimated dollars for equipment, construction, and operation activities to conduct a remedial action. Indirect costs include the estimated dollars for activities that support the remedial action (such as construction management, project management, and management reserve). In accordance with the RI/FS study guidance, the costs presented in Table 9-2 are estimates (-30 to +50%). Actual costs will vary based on the final design and detailed cost itemization.

The costs associated with Alternative 1 (No Action With Monitoring) involve only radiation surveys. Post-closure costs were estimated for the full duration of the 100-year period of monitoring. The costs associated with Alternative 2 (Limited Action) involve only radiation surveys and maintaining existing fences, such as the one located at the Sewage Leach Pond Soil Contamination Area. For Alternatives 3a (engineered barrier) and 3b (native soil cover) the cost estimate is based on constructing the engineered and native soil cover, installing surface water diversion controls, using monitoring equipment, conducting analyses, and post-closure maintenance and monitoring. Costs for the native soil cover are lower than for the engineered cover because of the simple design. At the Chemical Waste Pond, costs associated with excavation, treatment, and disposal are considered moderate. The estimated cost for Alternative 5 (excavation and disposal) is relatively high. The implementation requirements significantly increase the cost associated with this alternative. No post-closure monitoring or care is required because the contaminants will be removed.

## 7.4 Modifying Criteria

The modifying criteria, state and community acceptance, are used in the final evaluation of remedial alternatives. For both of these criteria, the factors include the elements of the alternatives that are supported, the factors of the alternatives that are not supported, and the elements of the alternatives that have strong opposition.

### 7.4.1 State Acceptance

The IDHW has been involved in the development and review of the RI/FS report, the Proposed Plan, and this ROD. All comments received from IDHW on these documents have been resolved and incorporated into these documents accordingly. In addition, IDHW has participated in public meetings where public comments and concerns have been received and responses offered.

The IDHW concurs with the selected remedial alternatives for the sites contained in this ROD and is signatory to the ROD with DOE and EPA.

### 7.4.2 Community Acceptance

Community participation in the remedy selection process includes participation in the public meetings held in March 1997 and review of the Proposed Plan during the public comment period of March 10, 1997 through May 9, 1997. Community acceptance is summarized in the Responsiveness Summary presented as Appendix A of this document. The Responsiveness Summary includes comments received either verbally or in writing from the public, and the agencies' responses to these comments.

A total of about twenty people not associated with the project attended the Proposed Plan public meetings. Overall, twenty citizens provided formal comments; of these, six citizens provided verbal comments, and fourteen provided written comments. All comments received on the proposed plan were considered during the development of this ROD.

As can be seen in the Responsiveness Summary, the ROD was substantively modified and improved in response to comments made by the public. Comments were often incorporated directly or were modified and included in the decision. In other cases, the modifications were made to the document to add greater explanation as to why a comment could not be incorporated.

In addition to their direct impact on the decision and the document, public comments triggered focused review of the sections highlighted by each commentor. The DOE, EPA, and the State review of these sections and the document as a whole resulted in further modifications and improvements to the decision. The agencies appreciate the public's participation in this process and acknowledge the value of public comment.

# 8. SELECTED REMEDY

The results of investigations at OU 2-13, WAG 2, TRA, at INEEL indicate that eight sites exceed a 1 in 10,000 risk or greater than 1.0 hazard index (indicates adverse noncarcenogenic health effects) to human health and/or the environment and thus pose an unacceptable risk; 47 sites do not exceed a 1 in 10,000 risk and therefore require no action. Please note that there are no unacceptable cumulative effects from the eight sites, and the remedial actions being recommended address individual risks as well as preventing cumulative risks to a future residential receptor at WAG 2. Based on consideration of the requirements of CERCLA, the detailed analysis of alternatives, and public comments, DOE-ID, EPA, and IDHW have selected the following alternatives for the sites contained in this ROD (Table 8-1).

Table 7-3 provides a summary of how the selected remedy for each ranks relative to one another. This comparative analysis provides a measure of the relative performance of alternatives against each evaluation criterion. The purpose of this comparison is to identify the relative advantages and disadvantages associated with each alternative.

## 8.1 Description of Selected Remedy

The selected remedies for each are described in the following sections.

### 8.1.1 Warm Waste Pond (TRA-03)

The selected remedy for the Warm Waste Pond 1952 and 1957 cells is Alternative 3a (containment with an engineered cover and institutional controls). This alternative was found to provide the greatest level of protectiveness to human health and the environment and had substantially lower costs than the excavation and disposal alternative. Implementation of the engineered cover is slightly more difficult than the native soil cover alternative, but the engineered cover provides greater permanence and requires less maintenance. Because contaminants are being left in place, institutional controls will be required to remain for the length of time that the contaminants pose an unacceptable risk to human health or the environment (at least 100 years). These institutional controls are to include soil cover integrity monitoring and maintenance, surface water diversions, access restrictions, and long-term environmental monitoring. Institutional controls are assumed to remain in effect for at least 100 years. Five-year reviews will be used to ensure that the remedy remains protective and appropriate. Before placement of the final cover, the 1957 cell may be filled to grade with CERCLA-contaminated soils from surrounding INEEL sites. As approved by the agencies, all soils used to fill the Warm Waste Pond to grade will have to be consistent with what has been placed to date in the 1957 cell in terms of contaminant type and concentration.

This alternative will reduce human exposure by preventing direct contact with and exposure to contaminants and will inhibit or eliminate potential intrusion of contaminated soils by both human and ecological receptors (i.e., burrowing mammals and deep-rooted vegetation). Under this alternative, groundwater monitoring will be continued to ensure that groundwater concentrations do not increase to unacceptable levels and that modeling predictions remain valid.

For the 1964 cell, where previous interim remedial action has already been completed, a basalt riprap or cobble gravel layer will be placed on top of the current native soil surface to inhibit intrusion or future excavation at the and to increase the permanence of the remedy.

**Table 8-1**. Selective remedial alternatives for sites of concern in OU 2-13.

| | Selected Remedy |
|---|---|
| Warm Waste Pond (TRA-03) 1952 and 1957 cells | Containment with an engineered cover and institutional controls |
| Warm Waste Pond 1964 cell | Final basalt riprap or cobble gravel layer on existing native soil cover and institutional controls |
| Chemical Waste Pond (TRA-06) | Native soil cover and institutional controls, with possible excavation, treatment, and disposal |
| Cold Waste Pond (TRA-08) | Excavation and disposal |
| Sewage Leach Pond (TRA-13) | Containment with a native soil cover and institutional controls |
| Soil Surrounding Hot Waste Tanks at Building TRA-613 (TRA-15) | Limited Action for at least 100 years |
| Soil Surrounding Tanks 1 and 2 at Building TRA-630 (TRA-19) | Limited Action with implementation of a contingent excavation and disposal option |
| Brass Cap Area | Limited Action with implementation of a contingent excavation and disposal option |
| Sewage Leach Pond Berms and Soil Contamination Area | Limited Action for at least 100 years; berms will be placed in the floor of the Sewage Leach Pond |

Performance standards will be implemented to ensure that the engineered cover provides protection against direct exposure to the contaminated waste. These standards are described in Section 8.2.

Recent investigations have determined that RCRA-listed waste may have been present in the TRA warm waste system when discharges from the warm waste system to the pond occurred. In addition, soil placed in the Warm Waste Pond from Test Area North (TAN) during the OU 10-06 removal action may have been contaminated with RCRA-listed waste. Therefore, the Warm Waste Pond soils will be managed in a manner consistent with the hazardous waste determination to be performed at the time of the remedial action. Any final determination to be made in regard to management of these soils will be pursued within time frames capable of supporting the schedule to be established in the RD/RA Scope of Work.

The soil from TAN placed in the TRA Warm Waste Pond during the OU 10-06 removal action may have been contaminated with low levels of PCBs. This soil was analyzed for PCBs; however, none were detected. The maximum detection limit of the data set was 0.220 ppm. The agencies have determined that these soils need not be managed as PCB-contaminated soil since the residual PCB levels are below the OSWER directive guidance level of 25 ppm at superfund sites.

In summary, the containment remedy for the Warm Waste Pond is protective of human health and the environment, complies with ARARs, provides short- and long-term effectiveness, is readily implementable, and is cost effective. The engineered cover design has been shown to be effective at other sites contaminated with radionuclides. Institutional controls will be implemented as described in Section 7.2.2.

### 8.1.2 Chemical Waste Pond (TRA-06)

The selected remedy for the Chemical Waste Pond is Containment with a Native Soil Cover and Institutional Controls with Possible Excavation, Treatment, and Disposal. The need for excavation, treatment and disposal will be determined on the basis of additional sampling to be performed during the remedial design phase. The agencies have concurred that excavating and disposing of contaminated sediments in the bottom of the pond before filling the pond to grade or constructing a native soil cover will meet the cleanup goals for the Chemical Waste Pond. However, it is not clear which is most cost effective. Cost effectiveness is dependent on the amount of soil that would need to be excavated and the requirements for its management as well as the design of the cover. If only small amounts of contaminated soil would need to be excavated and disposed, and the level of mercury in that soil is below levels that would require treatment, then excavation and disposal would likely be more cost effective. This is because the disposal cost would be low, the pond could be filled to grade with minimal backfill specifications, and long-term monitoring and maintenance needs would be eliminated. If larger amounts of soils would need to be excavated and disposed to meet cleanup goals, and the levels of mercury in the soil would require treatment by stabilization or retorting to meet hazardous waste regulations, then the soil cover would be the more cost-effective remedy. However, if the contamination is left in place, the cover would require more strict specifications to enhance runoff and reduce erosion. In order to make the final determination, further sampling and analysis needs to be completed in the pond to define the amount of soils that would require excavation and how the soil would have to be managed (i.e., soils contaminated with mercury above 260 mg/kg must be treated by retorting the soil if excavated and thereby generated as hazardous waste). Therefore, the specific design of the remedy selected in this ROD, native soil cover with possible excavation and disposal after sampling, will be dependent upon the results of a sampling and analysis effort as a first step after signature of the ROD but before the final design is completed.

If contaminants are left in place, the final cover design will consist of a sloped surface with a 1-ft peak similar to that depicted in Figure 7-1. Environmental monitoring and institutional controls would be maintained for at least 100 years. Institutional controls and access restrictions as described in Section 7.2.2 will be required. Five-year reviews will be used to evaluate the effectiveness and appropriateness of this alternative.

Performance standards will be implemented to ensure that the native-soil cover provides protection against direct exposure to the contaminated wastes. These standards are described in Section 8.2.

### 8.1.3 Cold Waste Pond (TRA-08)

The selected alternative for the Cold Waste Pond is Alternative 5, Excavation and Disposal. Costs for this alternative were lower due to the estimated amount of contaminated sediment requiring removal [0 to 6 in. (0 to 15 cm)] versus the amount of fill materials that would be required under the two containment options (Alternatives 3a and 3b). It is anticipated that a hot spot removal will be performed on the basis of field measurements and laboratory data collected. This alternative provides the highest degree of long-term effectiveness and permanence. Only sediments with contaminant concentrations exceeding risk-based cleanup goals will be excavated and appropriately disposed.

Performance standards will be implemented to ensure that the excavation and disposal of contaminated soil provide protection against direct exposure to the contaminated wastes. These standards are described in Section 8.2.

### 8.1.4 Sewage Leach Pond (TRA-13)

The selected alternative for the Sewage Leach Pond is Alternative 3b (containment with a native soil cover and institutional controls, as described above). Institutional controls will be required to remain for the length of time that the contaminants pose an unacceptable risk to human health or the environment (at least 100 years). Before the barrier is constructed, the pond will initially be backfilled with soils from the contaminated berms, then filled with clean soil to grade. This will ensure that any contamination from the berms is placed in the bottom of the pond. The final cover design will consist of a sloped surface with a 1-ft peak. The cover surface would be completed with a gravel mulch and vegetated with crested wheatgrass. The slope surface would be used to divert surface water runoff and to promote evapotranspiration. This alternative would effectively reduce risks to human health and the environment at relatively low implementation costs compared to excavation and disposal. The native soil cover effectively reduces the potential for human and environmental exposure to contaminants but requires long-term monitoring and maintenance to ensure that migration of contaminants to receptor pathways does not occur. This alternative was compared and selected based on remedy selection criteria as described in Section 7.3. Five-year reviews will be used to evaluate the effectiveness and appropriateness of this alternative.

Performance standards will be implemented to ensure that the native-soil cover provides protection against direct exposure to the contaminated wastes. These standards are described in Section 8.2.

### 8.1.5 Soil Surrounding Hot Waste Tanks at Building 613 (TRA-15)

The selected alternative for the soil surrounding Hot Waste Tanks at Building 613 is Alternative 2, Limited Action, because risk estimates are only slightly above criteria for current and future workers. Existing administrative and institutional controls will continue to be used to be protective of occupational scenarios. These controls would be maintained for a period of 100 years. Performance standards will be implemented to ensure protection against direct exposure to the contaminated wastes while the is under institutional control. At the end of 100 years, no other action will be required because radioactive decay of contaminants will have occurred to levels that no longer represent an unacceptable risk to human health and the environment.

### 8.1.6 Soil Surrounding Tanks 1 and 2 at Building 630 (TRA-19)

The selected alternative for the Soil Surrounding Tanks 1 and 2 at Building 630 is Alternative 2 (Limited Action), with the contingency that if controls established under the Limited Action are not maintained then an Excavation and Disposal option would be implemented. Recent investigations have determined that RCRA-listed waste may have been present in the TRA warm and hot waste systems when leaks from the systems to the environment occurred. If soil is excavated for disposal, a hazardous waste determination will be required. Therefore, the TRA-19 soils will be managed in a manner consistent with the hazardous waste determination to be performed at the time of excavation and disposal. Excavation would occur to a maximum depth of potential intrusion [10 ft (3 m) or the maximum depth at which contaminant concentrations exceed PRGs, whichever is less]. The excavated soil will be transported to an approved disposal facility. This alternative was selected on the basis of long-term effectiveness, permanence, and costs that are roughly equivalent to those for Alternative 3a, containment with an engineered cover.

This alternative is selected because the contamination associated with these two sites is located under the ground surface in and around active radioactive waste piping and tank systems and buildings where access is physically limited. Therefore, excavation or containment alternatives are not fully implementable at this time, because it cannot be ensured that adequate contamination could be removed to eliminate the need for the controls that would be in place under the Limited Action alternative. If during 5-year reviews it is determined that the controls established under the Limited Action alternative are not maintainable or do not continue to be protective, the contingency of Excavation and Disposal would be implemented. Selection of the Limited Action alternative in this ROD would require that existing controls such as access restrictions and worker protection programs be maintained to prevent exposure above acceptable levels to workers or future inhabitants.

The identification of Limited Action as the preferred alternative, with an Excavation and Disposal option contingency, is based on the 100-year industrial land use assumption for TRA. The validity of this assumption will be evaluated during the 5-year review process. However, the maximum duration of time for which this assumption may be considered valid is up to 100 years from now.

Performance standards will be implemented to ensure protection against direct exposure to the contaminated wastes while the site is under institutional control. When excavation and disposal take place at some point in the future, the performance standards described in Section 8.2 will be implemented to ensure that excavating and disposal activities provide protection against direct exposure to the contaminated wastes.

### 8.1.7 Brass Cap Area

As with TRA-19, the selected alternative is Limited Action, with the contingency that, if controls established under the Limited Action are not maintained then an Excavation and Disposal option would be implemented. This alternative provides long-term effectiveness, permanence, and reasonable costs when compared with the other remedies evaluated.

This consists of radioactively contaminated soil located below the ground surface inside the security fence at TRA. The source of contamination is attributed to a leaking warm waste line; however, it is acknowledged that possible releases from a nearby hot waste line may have occurred and that this contamination may not be readily distinguishable from any warm waste line releases. Some contaminated soil and concrete were excavated and removed during repair of the leaking line. The excavation was backfilled with clean soil, and the concrete surface was replaced. Recent investigations have determined that RCRA-listed waste may have been present in the TRA warm and hot waste systems when leaks from the systems to the environment occurred. If soil is excavated for disposal, a hazardous waste determination will be required. Therefore, the Brass Cap Area soils will be managed in a manner consistent with the hazardous waste determination to be performed at the time of excavation and disposal.

The identification of Limited Action as the preferred alternative, with an Excavation and Disposal option contingency, is based on the 100-year industrial land use assumption for TRA. The validity of this assumption will be evaluated during the 5-year review process. However, the maximum duration of time for which this assumption may be considered valid is up to 100 years from now.

Performance standards will be implemented to ensure protection against direct exposure to the contaminated wastes while the is under institutional control. When excavation and disposal take place at some point in the future, the performance standards described in Section 8.2 will be implemented to ensure that excavating and disposal activity provides protection against direct exposure to the contaminated wastes.

### 8.1.8 Sewage Leach Pond Berm and Soil Contamination Area

The selected remedy for the Sewage Leach Pond Berms and Soil Contamination Area is Alternative 2 (Limited Action), consisting of existing administrative and institutional controls. As previously described in Section 8.1.4 for the Sewage Leach Pond (TRA-13), the contaminated berms will be placed in the bottom of the pond before completion of the final clean, native soil cover. The remaining low-level radionuclide-contaminated soils will be left in place, and exposure to these contaminants will be minimized through the use of fences, signs, and monitoring (i.e., field measurement surveys). Institutional controls will be maintained for a period of at least 100 years. This will be protective of occupational scenarios while achieving acceptable risks within 100 years because of natural radioactive decay. A CERCLA 5-year review will be conducted to ensure that the administrative controls are being properly maintained and that the predicted decrease in contaminant concentrations does occur.

### 8.1.9 No Action Site

The No Action alternative was reaffirmed or selected as the appropriate alternative for the 47 sites at TRA listed below. This alternative was chosen because there are no known or suspected contaminant releases, contaminants exceeding acceptable levels, or previous cleanups resulting in unacceptable risks to human health and the environment. For this reason, long-term environmental monitoring is not warranted for these sites.. It should be noted that the eliminated No Action sites do not pose a risk in combination.

***Operable Unit—None***

- TRA-10 TRA MRT Construction Excavation Pile
- TRA-23 TRA ETR Excavation Rubble Pile
- TRA-24 TRA Guardhouse Construction Rubble Pile
- TRA-25 TRA Sewer Paint Settling Pond Rubble Pile
- TRA-26 TRA Rubble by USGS Observation Well
- TRA-27 TRA North Storage Area Rubble Pile
- TRA-28 TRA North (Landfill) Rubble
- TRA-29 TRA ATR Construction Pile
- TRA-32 TRA West Road Rubble Pile
- TRA-33 TRA West Staging Area/Drainage Ditch Rubble

***Operable Unit 2-01***

- TRA-02 TRA Paint Shop Ditch

***Operable Unit 2-02***

- TRA-14 TRA Inactive Gasoline Tank at TRA-605

- TRA-17 TRA Inactive Gasoline Tank at TRA-616
- TRA-18 TRA Inactive Gasoline Tank at TRA-619
- TRA-21 TRA Inactive Tank, North Side of MTR-643
- TRA-22 TRA Inactive Diesel Fuel Tank at ETR-648

*Operable Unit 2-03*

- None TRA-614 Oil Storage North
- TRA-01 TRA Acid Spill Disposal Pit
- TRA-11 TRA French Drain at TRA-645
- TRA-12 TRA Fuel Oil Tank Spill (TRA-727B)
- TRA-20 TRA Brine Tank (TRA-731) at TRA-631
- TRA-40 TRA Tunnel French Drain (TRA-731)

*Operable Unit 2-04*

- None TRA PCB Spill at TRA-619
- None TRA PCB Spill at TRA-626
- None TRA-627 #5 Oil Spill
- None TRA PCB Spill at TRA-653
- None TRA-670 Petroleum Product Spill
- None TRA PW 13 Diesel Fuel Contamination
- TRA-09 TRA Spills at TRA Loading Dock (TRA-722)
- TRA-34 TRA North Storage Area

*Operable Unit 2-05*

- None TRA-603/605 Tank
- TRA-16 TRA Inactive Radionuclide Contaminated Tank at TRA-614

*Operable Unit 2-06*

- TRA-30 TRA Beta Building Rubble
- TRA-31 TRA West Rubble
- TRA-35 TRA Rubble East of West Road near Beta Building Rubble Pile

*Operable Unit 2-07*

- None TRA-653 Chromium-Contaminated Soil

*Operable Unit 2-08*

- TRA-37 TRA MTR Canal in basement of TRA-603

*Operable Unit 2-09*

- TRA-07 TRA Sewage Treatment Plant (TRA-624) and Sludge Pit (TRA-07)

*Operable Unit 2-10*

- TRA-03B TRA Warm Waste Pond (Sediments)

*Operable Unit 2-11*

- TRA-03A TRA Warm Waste Leach Pond (TRA-758)
- TRA-04 TRA Warm Waste Retention Basin (TRA-712)
- TRA-05 TRA Waste Disposal Well, Sampling Pit (764) and Sump (703)

*Operable Unit 2-12*

- None Perched Water RI/FS

*Operable Unit 2-13*

- TRA-41 French Drain
- TRA-42 Diesel Unloading Pit
- None Hot Tree
- None ETR Stack Area

The agencies concur with the No Action alternative selected for the above-listed sites.

For those sites for which no action is being taken based on land use assumptions, those assumptions will be reviewed as part of the 5-year review. In addition, legacy waste that has been generated as a result of previous sampling activities at WAG 2 (i.e., investigation-derived waste) will be appropriately characterized, assessed, and dispositioned in accordance with regulatory requirements to achieve remediation goals consistent with remedies established for sites under this ROD.

## 8.2 Remediation Goals

The purpose of this response action is to inhibit potential exposure for human and environmental receptors and to minimize the spread of contamination. For the majority of disposal pond sites, this will be accomplished by constructing long-term covers (caps) and restricting access to the sites. For the subsurface release sites, this will be primarily accomplished by eventual excavation and disposal of the contaminated soils. For the remaining sites, this will be accomplished through institutional controls.

### 8.2.1 Containment System Performance Standards

Performance standards will be implemented to ensure that the cover systems provide protection against direct exposure to the waste at the sites with native-soil covers or engineered covers. The performance standards identified for the containment alternative include:

- Installation of covers that are designed to remain in existence for the length of time an unacceptable risk is posed, in order to discourage any individual from inadvertently intruding into the buried waste or from contacting the waste.

- Application of maintenance and surface monitoring programs for the containment systems capable of providing early warning of releases of radionuclides and non-radionuclide contaminants of concern from the disposal sites before they leave the site boundary

- Institution of restrictions limiting land use for at least 100 years

- Implementation of surface water controls to direct surface water away from the disposed waste

- Elimination, to the extent practicable, of the need for ongoing active maintenance of the disposal sites following closure so that only surveillance, monitoring, or minor custodial care are required

- Placement of adequate cover to inhibit erosion by natural processes for the specified design lives of the covers

- Incorporation of features to inhibit biotic intrusion into the Warm Waste Pond 1952 and 1957 cells.

The inspection and maintenance of the cover system will be conducted concurrent with the radiological survey program. Implementation of the maintenance and survey programs will ensure protection of human health and the environment from any unacceptable risks. These programs will be implemented annually for the first 5 years following completion of the caps. The necessity for continued monitoring will then be reevaluated and defined as determined appropriate by the agencies during subsequent 5-year reviews.

### 8.2.2 Excavation and Disposal Performance Standards

Performance standards will be implemented to ensure that excavation and disposal activities will result in protection against direct exposure to the contaminants during excavation and after disposal. The performance standards identified for this alternative include:

- Physically removing the source of contamination so that the pathway by which a future receptor may be exposed is broken. This will be determined by confirmation soil sampling to ensure that the cleanup meets or exceeds preliminary remediation goals.

### 8.2.3 Limited Action Performance Standards

Performance standards will be implemented to ensure that institutional controls will result in protection against direct exposure to the contaminants for a period of at least 100 years (corresponding to the point in time at which the contaminants have decayed to below levels of concern). The performance standards identified for this alternative include:

- Installation, where necessary, and maintenance of physical barriers to restrict unauthorized access. This may include fences, ground surface cover, and/or posted warning signs.

- An evaluation of existing management and administrative controls to ensure that protection against direct exposure to contaminants is effective. This evaluation will be performed as part of the remedial design.

- Implementation of additional administrative controls as determined necessary by the evaluation described in bullet 2 of this subsection.

### 8.2.4 Treatment Performance Standards

Performance standards will be implemented to ensure that treatment of contaminated soil at the Chemical Waste Pond, if necessary, will achieve acceptable levels. The performance standards identified for treatment include:

- Treatment of contaminated soil to at least 0.2 mg/L TCLP for mercury.

## 8.3 Estimated Cost Details for the Selected Remedy

A summary of the costs for each of the remedial action alternatives evaluated is presented in Table 9-2. Tables 8-2 through 8-7 provide detailed breakdowns of the estimated costs for the selected remedies.

**Table 8-2.** Warm Waste Pond engineered barrier detailed cost estimate.

| Cost Elements | | Estimated Costs ($) |
|---|---|---|
| **Management and Documentation Costs** | | |
| FFA/CO Management and Oversight | | 375,000 |
| LMITCO Project Management and Title III Inspection | | 188,356 |
| Construction Project Management (Parsons) | | |
| Remedial Design/Remedial Action Statement of Work and Remedial | | 313,926 |
| Design/Remedial Action Work Plan | | 22,000 |
| | **Subtotal** | **899,282** |
| **Remedial Design** | | |
| Title Design Construction Document Package | | 178,400 |
| Remedial design documentation | | 60,000 |
| Pre-final Inspection Report | | 8,000 |
| | **Subtotal** | **246,400** |
| **Construction Subcontract** | | |
| Mobilize/demobilize cap subcontractor | | 20,000 |
| Construction of cap | | 688,939 |
| Surface water control | | 16,000 |
| Access restriction fencing | | 80,000 |
| Contractor overhead and profit | | 241,482 |
| Procurement and General and Administrative | | 376,711 |
| | **Subtotal** | **1,423,132** |
| **Post-closure Costs** | | |
| Post-closure management | | 3,125,000 |
| Annual Operations and Management reports | | 250,000 |
| WAG 5-year review | | 500,000 |
| Remedial action report | | 17,000 |
| Warm Waste Pond 100-year long-term total costs | | 2,120,000 |
| | **Subtotal** | **5,512,000** |
| **Total in 1997 dollars[a]** | | **8,580,814** |
| **Total in net present value dollars** | | **6,843,216** |

a. Costs shown are in 1997 dollars and net present value dollars. $8,580,814 in 1997 dollars is equal to $6,843,216 net present value dollars (net present value takes the 1997 dollar amount and assumes variable annual inflation factors for the first 10 years, and a constant 5% annual inflation rate after that for a total of 100 years. A constant 5% discount rate is then assumed, which results in the net present value amount).

**Table 8-3**. Chemical Waste Pond detailed cost estimate.

| Cost Elements | | Estimated Costs ($) |
|---|---|---|
| **Management and Documentation Costs** | | |
| FFA/CO Management and Oversight | | 375,000 |
| LMITCO Project Management and Title III Inspection | | 23,166 |
| Construction Project Management (Parsons) | | 38,610 |
| Remedial Design/Remedial Action Statement of Work and Remedial Design/Remedial Action Work Plan | | 22,000 |
| | **Subtotal** | **458,776** |
| **Remedial Design** | | |
| Title Design Construction Document Package | | 65,600 |
| Remedial design documentation | | 60,000 |
| Pre-final Inspection Report | | 8,000 |
| | **Subtotal** | **133,600** |
| **Construction Subcontract (Native Soil cover)** | | |
| Mobilize/demobilize cap subcontractor | | 10,000 |
| Construction of cap | | 59,000 |
| Surface water control | | 5,000 |
| Access restriction fencing | | 25,000 |
| Contractor overhead and profit | | 29,700 |
| Procurement and General and Administrative | | 46,332 |
| | **Subtotal** | **175,032** |
| **Construction Subcontract (excavate, treat, dispose)** | | |
| Excavate and haul to on treatment | | 26,850 |
| On treatment | | 859,200 |
| Transport concentrated waste off | | 3,200 |
| Transport clean soils back to Chemical Pond | | 4,136 |
| Mobilize/demobilize | | 10,000 |
| | **Subtotal** | **903,386** |
| **Post-closure Costs (if contamination left in place)** | | |
| Post-closure management | | 3,125,000 |
| Annual Operations and Management reports | | 250,000 |
| WAG 5-year review | | 500,000 |
| Remedial action report | | 17,000 |
| Chemical Waste Pond long-term maintenance costs | | 822,000 |
| | **Subtotal** | **4,714,000** |
| **Total in 1997 dollars (Native Soil Cover only)** | | **5,481,408** |
| **Total in net present value dollars** | | **3,904,959** |

**Table 8-4**. Cold Waste Pond excavate and dispose detailed cost estimate.

| Cost Elements | | Estimated Costs ($) |
|---|---|---|
| **Management and Documentation Costs** | | |
| FFA/CO Management and Oversight | | 375,000 |
| LMITCO Project Management and Title III Inspection | | 28,548 |
| Construction Project Management (Parsons) | | 47,580 |
| Remedial Design/Remedial Action Statement of Work and Remedial Design/Remedial Action Work Plan | | 22,000 |
| Packaging, Shipping, Transportation Plan | | 25,000 |
| | **Subtotal** | **498,128** |
| **Remedial Design** | | |
| Title Design Construction Document Package | | 44,600 |
| Remedial design documentation | | 60,000 |
| Pre-final Inspection Report | | 8,000 |
| | **Subtotal** | **112,600** |
| **Construction Subcontract** | | |
| Excavate and haul costs | | 112,000 |
| Disposal costs | | 896,000 |
| Mobilize/demobilize cap subcontractor | | 10,000 |
| Contractor overhead and profit | | 36,600 |
| Procurement and General and Administrative | | 57,096 |
| | **Subtotal** | **1,111,696** |
| **Post-closure Costs** | | |
| Remedial action report | | 17,000 |
| | **Subtotal** | **17,000** |
| **Total in 1997 dollars** | | **1,739,424** |
| **Total in net present value dollars** | | **1,592,818** |

**Table 8-5.** Sewage Leach Pond native soil cover detailed cost estimate.

| Cost Elements | | Estimated Costs ($) |
|---|---|---|
| **Management and Documentation Costs** | | |
| FFA/CO Management and Oversight | | 375,000 |
| LMITCO Project Management and Title III Inspection | | 28,080 |
| Construction Project Management (Parsons) | | 46,800 |
| Remedial Design/Remedial Action Statement of Work and Remedial Design/Remedial Action Work Plan | | 22,000 |
| | **Subtotal** | **471,880** |
| **Remedial Design** | | |
| Title Design Construction Document Package | | 65,600 |
| Remedial design documentation | | 60,000 |
| Pre-final Inspection Report | | 8,000 |
| | **Subtotal** | **133,600** |
| **Construction Subcontract** | | |
| Mobilize/demobilize cap subcontractor | | 20,000 |
| Construction of cap | | 70,000 |
| Surface water control | | 5,000 |
| Access restriction fencing | | 25,000 |
| Contractor overhead and profit | | 36,000 |
| Procurement and G&A | | 56,160 |
| | **Subtotal** | **212,160** |
| **Post-closure Costs** | | |
| Post-closure management | | 3,125,000 |
| Annual Operations and Management reports | | 250,000 |
| WAG 5-year review | | 500,000 |
| Remedial action report | | 17,000 |
| Sewage Leach Pond long-term maintenance costs | | 934,000 |
| | **Subtotal** | **4,826,000** |
| **Total in 1997 dollars** | | **5,643,640** |
| **Total in net present value dollars** | | **4,028,832** |

**Table 8-6.** TRA-15, TRA-19, Brass Cap Area limited action detailed cost estimate.

| Cost Elements | | Estimated Costs ($) |
|---|---|---|
| **Management and Documentation Costs** | | |
| FFA/CO Management and Oversight | | 125,000 |
| LMITCO Project Management and Title III Inspection | | 983 |
| Construction Project Management (Parsons) | | 1,638 |
| Remedial Design/Remedial Action Statement of Work and Remedial Design/Remedial Action Work Plan | | 22,000 |
| | **Subtotal** | **149,621** |
| **Remedial Design** | | |
| Title Design Construction Document Package | | 18,800 |
| Remedial design documentation | | 60,000 |
| Pre-final Inspection Report | | 8,000 |
| | **Subtotal** | **86,800** |
| **Inspection and Maintenance Costs** | | |
| Access restriction fencing | | 35,000 |
| Surface water diversion | | 700 |
| Subcontractor overhead and profit | | 1,260 |
| Procurement and General and Administrative fees | | 1,966 |
| | **Subtotal** | **7,426** |
| **Post-closure Costs** | | |
| Post-closure management | | 3,093,750 |
| Annual Operations and Management reports | | 247,500 |
| Remedial Action Report | | 17,000 |
| WAG 5-year review | | 500,000 |
| Long-term maintenance costs | | 570,000 |
| | **Subtotal** | **4,428,250** |
| **Total in 1997 dollars** | | **4,672,099** |
| **Total in net present value dollars** | | **2,312,337** |

**Table 8-7.** Sewage Leach Pond Berm and Soil Contamination Area limited action detailed cost estimate.

| Cost Elements | | Estimated Costs ($) |
|---|---|---|
| **Management and Documentation Costs** | | |
| FFA/CO Management and Oversight | | 125,000 |
| LMITCO Project Management and Title III Inspection | | 28,080 |
| Construction Project Management (Parsons) | | 46,800 |
| Remedial Design/Remedial Action Statement of Work and Remedial Design/Remedial Action Work Plan | | 22,000 |
| | **Subtotal** | **221,880** |
| **Remedial Design** | | |
| Title Design Construction Document Package | | 18,800 |
| Remedial Design Documentation | | 60,000 |
| Pre-final Inspection Report | | 8,000 |
| | **Subtotal** | **86,800** |
| **Inspection and Maintenance Costs** | | |
| Access restriction fencing | | 100,000 |
| Surface water diversion | | 20,000 |
| Subcontractor overhead and profit | | 36,000 |
| Procurement and General and Administrative fees | | 56,160 |
| | **Subtotal** | **212,160** |
| **Post-closure Costs** | | |
| Post-closure management | | 3,093,750 |
| Annual Operations and Management reports | | 247,500 |
| Remedial action report | | 17,000 |
| WAG 5-year review | | 500,000 |
| Long-term maintenance costs | | 570,000 |
| | **Subtotal** | **4,428,250** |
| **Total in 1997 dollars** | | **4,949,090** |
| **Total in net present value dollars** | | **3,497,155** |

**Table 8-8.** Brass Cap Area excavation and disposal contingent remedy detailed cost estimate.

| Cost Elements | | Estimated Costs ($) |
|---|---|---|
| **Management and Documentation Costs** | | |
| FFA/CO Management and Oversight | | 375,000 |
| LMITCO Project Management and Title III Inspection | | 6,578 |
| Construction Project Management (Parsons) | | 10,963 |
| Remedial Design/Remedial Action Statement of Work and Remedial Design/Remedial Action Work Plan | | 47,000 |
| | **Subtotal** | **439,541** |
| **Remedial Design** | | |
| Title Design Construction Document Package | | 44,600 |
| Remedial Design Documentation | | 60,000 |
| Pre-final Inspection Report | | 8,000 |
| | **Subtotal** | **112,600** |
| **Construction Subcontract** | | |
| Excavate and haul | | 5,250 |
| Transport and disposal costs | | 42,000 |
| Refill borrowed and reseeding | | 5,420 |
| Mobilize/demobilize | | 10,000 |
| Contractor overhead and profit | | 6,201 |
| Procurement and General and Administrative | | 9,674 |
| | **Subtotal** | **78,545** |
| **Post-closure Costs** | | |
| Remedial action report | | 17,000 |
| | **Subtotal** | **17,000** |
| **Total in 1997 dollars** | | **647,686** |
| **Total in net present value dollars** | | **598,512** |

**Table 8-9**. TRA-19 excavation and disposal contingent remedy detailed cost estimate.

| Cost Elements | | Estimated Costs ($) |
|---|---|---|
| **Management and Documentation Costs** | | |
| FFA/CO Management and Oversight | | 375,000 |
| LMITCO Project Management and Title III Inspection | | 3,801 |
| Construction Project Management (Parsons) | | 6,334 |
| Remedial Design/Remedial Action Statement of Work and Remedial Design/Remedial Action Work Plan | | 47,000 |
| | **Subtotal** | **439,541** |
| **Remedial Design** | | |
| Title Design Construction Document Package | | 44,600 |
| Remedial Design Documentation | | 60,000 |
| Pre-final Inspection Report | | 8,000 |
| | **Subtotal** | **112,600** |
| **Construction Subcontract** | | |
| Excavate and haul | | 1,150 |
| Transport and disposal costs | | 9,200 |
| Refill borrowed and reseeding | | 5,092 |
| Mobilize/demobilize | | 10,000 |
| Contractor overhead and profit | | 4,873 |
| Procurement and General and Administrative | | 2,601 |
| | **Subtotal** | **37,916** |
| **Post-closure Costs** | | |
| Remedial action report | | 17,000 |
| | **Subtotal** | **17,000** |
| **Total in 1997 dollars** | | **599,651** |
| **Total in net present value dollars** | | **549,110** |

# 9. STATUTORY DETERMINATION

The selected remedy for each site meets the statutory requirements of CERCLA Section 121, the regulations contained in the NCP, and the requirements of the FFA/CO for the INEEL. All remedies meet the threshold criteria established in the NCP (i.e., protection of human health and the environment and compliance with ARARs). CERCLA also requires that the remedy use permanent solutions and alternative treatment technologies to the maximum extent practicable, and that the implemented action be cost effective. Finally, the statute includes a preference for remedies that employ treatment that permanently and significantly reduce the volume, toxicity, or mobility of hazardous wastes as their principal element. For many of the sites contaminated with radionuclides, effective treatment technologies are currently unavailable; therefore, the preference for permanent solutions cannot be met except through natural radioactive decay processes over time. For those sites where contaminated soils and sediments will be left in place at levels associated with a risk greater than 1E-04 and a hazard index greater than 1.0, a review will be conducted within 5 years and at least every 5 years thereafter, until determined by the agencies to be no longer necessary to ensure that the remedy continues to provide adequate protection of human health and the environment.

## 9.1 Protection of Human Health and the Environment

As described in Section 8, the selected remedy for each site satisfies the criterion of overall protection of human health and the environment.

### 9.1.1 Alternative 1: No Action

No remedial action is necessary to ensure continued protection of human health and the environment at the 47 sites identified in Section 8.9. Because no unacceptable risks to human health and the environment were identified, or those risks were mitigated during previous cleanups, the No Action alternative has been selectedand environmental monitoring is not warranted.

### 9.1.2 Alternative 2: Limited Action

Protection of human health is achieved by this alternative through existing administrative and institutional controls that reduce the potential for exposure to site contaminants. The use of routine maintenance, access restriction, long-term environmental monitoring, and surface water diversion are included in this remedy. Protection of environmental receptors is not ensured under this alternative. However, for TRA-15 19, Brass Cap Area, and Sewage Leach Pond Soil Contamination Area, for which this remedy was selected, no unacceptable risks to environmental receptors have been identified.

### 9.1.3 Alternatives 3a and 3b: Containment with Engineered Cover or Native Soil Cover

The containment cover alternatives prevent direct contact with contaminants by all potential receptors, reduce radiation external exposure through shielding, and reduce the likelihood of biointrusion (engineered cover only).

### 9.1.4 Alternative 4: Excavation, Treatment, and Disposal

This alternative provides maximum protection of human health and the environment by the reduction of toxicity, mobility, and volume of mercury-contaminated sediments through excavation and treatment. Following treatment, contaminated sediments would be disposed and would, therefore, no longer pose a risk to human and environmental receptors at OU 2-13.

### 9.1.5 Alternative 5: Excavation and Disposal

The excavation and disposal alternative provides the best protection of human health and the environment by removing contaminants that pose an unacceptable risk and placing them in a licensed disposal facility designed to protect human health and the environment.

## 9.2 Compliance with ARARs

In general, sites identified during the OU 2-13 RI/FS as needing remedial action are the result of releases to the environment that had little known potential to contain RCRA hazardous waste or PCBs. The exception is the Chemical Waste Pond, which was known to have received corrosive hazardous waste, and, more recently, wastewaters containing levels of mercury above the TCLP level. Recent evaluations have determined that small quantities of RCRA-listed solvents and PCBs may also be associated with some sites. RCRA-listed solvents may have been disposed to the warm wastewater and hot wastewater systems at TRA, resulting from the use of small quantities of solvents in TRA laboratories, which may have released small quantities of the solvent to drains that are connected to these systems. Trichloroethylene (TCE), a RCRA-listed solvent, and PCBs are associated with soil from TAN, which was placed in the 57 cell of the Warm Waste Pond during an OU 10-06 removal action.

Of the eight sites needing remedial action under this ROD, four are associated with the warm wastewater system, hot wastewater system, and/or OU 10-06 removal actions. The sites include the hot waste tanks (TRA-15), the hot waste catch tanks (TRA-19), the Brass Cap Area, and the Warm Waste Pond. Therefore, soils at these sites associated with releases from the warm waste system, hot waste system, and/or 10-06 removal actions will be managed in a manner consistent with the hazardous waste determination to be performed at the time of the remedial action. Any final determination to be made in regard to management of the Warm Waste Pond soils will be pursued within time frames capable of supporting the schedule to be established in the RD/RA SOW.

Soil from the Test Area North placed in the Warm Waste Pond during the OU 10-06 removal action may have been contaminated with very low levels of PCBs. This soil was analyzed for PCBs; however, none were detected. The maximum detection limit of the data set was 0.220 ppm. The agencies have determined that these soils need not be managed as PCB-contaminated soil since the residual PCB levels are below the office of solid waste and emergency response directive guidance level of 25 ppm at Superfund Sites. The data supporting this decision can be found in the OU 2-13 Administrative Record as attachments to agency comment responses to the OU 2-13 Draft ROD.

The selected remedies will be designed to comply with all chemical-specific, action-specific, and location-specific federal and state ARARs, as described in Section 7.3 and presented in Table 9-1.

**Table 9-1**. Summary of ARARs met by selected alternatives for OU 2-13 sites of concern.

| | | |
|---|---|---|
| **(1) Warm Waste Pond—Containment with an engineered barrier** | | |
| **Chemical-Specific ARARs** | | |
| 40 CFR 61.92 | NESHAPS for Radionuclides from DOE Facilities | Applicable |
| 40 CFR 61.93 | Emission Monitoring | Applicable |
| 40 CFR 61.94(a) | Emission Compliance | Applicable |
| IDAPA 16.01.01., .585 and .586 | Toxic Substances | Applicable |
| **Action-Specific ARARs** | | |
| It is anticipated that the requirements of 40 CFR 264.310 (a) (1) and (5) could be met for the 1964 cell demonstrating that contaminant migration to the aquifer does not pose an unacceptable risk. | | |
| 40 CFR 264.309(a) and (b) | Surveying and Recordkeeping | R & A |
| 40 CFR 264.310(a)(1)(2) (3) (4)(5) | Closure and post-closure care | R & A |
| 40 CFR 264.310(b) (1) (5) (6) | Closure and post-closure care | R & A |
| **Location-Specific ARARs** | | |
| **(2a) Chemical Waste Pond—Containment with native soil barrier** | | |
| **Chemical-Specific ARARs** | | |
| 40 CFR 61.92 | NESHAPS for Radionuclides from DOE Facilities | Applicable |
| 40 CFR 61.93 | Emission Monitoring | Applicable |
| 40 CFR 61.94(a) | Emission Compliance | Applicable |
| IDAPA 16.01.01., .585, and . 586 | Toxic Substances | Applicable |

**Table 9-1**. (continued).

| | | |
|---|---|---|
| **Action-Specific ARARs** | | |
| It is anticipated that the requirements of 40 CFR 264.310 (a)(1) and 5 could be met for the Chemical Waste Pond by demonstrating that contaminant migration to the aquifer does not pose an unacceptable risk. | | |
| 40 CFR 264.309(a) and (b) | Surveying and Recordkeeping | R & A |
| 40 CFR 264.310(a)(1)(2)(3)(4)(5) | Closure and Post Closure | R & A |
| 40 CFR 264.310(b)(1)(5)(6) | Closure and Post Closure | R & A |
| **2(b) Chemical Waste Pond—excavation and off-site disposal** | | |
| **Chemical-Specific ARARs** | | |
| 40 CFR 61.92 | NESHAPS Radionuclide Emissions from DOE Facilities | Applicable |
| 40 CFR 61.93 | Emission Monitoring | Applicable |
| 40 CFR 61.94(a) | Emission Compliance | Applicable |
| IDAPA 16.01.01.585 - .586 | Toxic Substances | Applicable |
| **Action-Specific ARARs** | | |
| 40 CFR 262.11 | Hazardous Waste Determination | Applicable |
| (Note: Waste excavated from the Chemical Waste Pond will be managed in accordance with the outcome of the hazardous waste determination) | | |
| **(3) Cold Waste Pond—Excavate and dispose onsite** | | |
| **Chemical-Specific ARARs** | | |
| 40 CFR 61.92 | NESHAPS for Radionuclides from DOE Facilities | Applicable |
| 40 CFR 61.93 | Emission Monitoring | Applicable |
| 40 CFR 61.94(a) | Emission Compliance | Applicable |
| IDAPA 16.01.01., .585, and .586 | Toxic Substances | Applicable |

**Table 9-1**. (continued).

| | | |
|---|---|---|
| **Action-Specific ARARs** | | |
| 40 CFR 262.11 | Hazardous Waste Determination | Applicable |
| Note: Waste excavated from the Cold Waste Pond will be managed in accordance with the outcome of the hazardous waste determination. | | |
| **(4) Soil Surrounding Tanks 1 and 2 at Building 630 (TRA-19)—Institutional control with excavate and disposal contingency** | | |
| **Chemical-Specific ARARS** | | |
| 40 CFR 61.92 | NESHAPS for Radionuclides from DOE Facilities | Applicable |
| 40 CFR 61.93 | Emission Monitoring | Applicable |
| 40 CFR 61.94(a) | Emission Compliance | Applicable |
| IDAPA 16.01.01., .585, and .586 | Toxic Substances | Applicable |
| **Action-Specific ARARs** | | |
| 40 CFR 262.11 | Hazardous Waste Determination | Applicable |
| Note: Waste excavated from TRA-19 will be managed in accordance with the outcome of the hazardous waste determination. | | |
| **(5) Brass Cap Area—Institutional control with excavate and disposal contingency** | | |
| **Chemical-Specific ARARs** | | |
| 40 CFR 61.92 | NESHAPS for Radionuclides from DOE Facilities | Applicable |
| 40 CFR 61.93 | Emission Monitoring | Applicable |
| 40 CFR 61.94(a) | Emission Compliance | Applicable |
| IDAPA 16.01.01., .585, and .586 | Toxic Substances | Applicable |
| **Action-Specific ARARs** | | |
| 40 CFR 262.11 | Hazardous Waste Determination | Applicable |

**Table 9-1**. (continued).

| | | |
|---|---|---|
| **Action-Specific ARARs** | | |
| 40 CFR 262.11 | Hazardous Waste Determination | Applicable |
| (Note: Waste excavated from the Brass Cap Area will be managed in accordance with the hazardous waste determination) | | |
| **(6) Soil Surrounding Hot Waste Tanks at Building 613 (TRA-15)—Institutional Control** | | |
| **Action-Specific ARARs** | | |
| 40 CFR 61.92 | NESHAPS for Radionuclides from DOE Facilities | Applicable |
| 40 CFR 61.93 | Emission Monitoring | Applicable |
| 40 CFR 61.94(a) | Emission Compliance | Applicable |
| IDAPA 16.01.01., .585, and .586 | Toxic Substances | Applicable |
| **(7) Sewage Leach Pond Berm and Soil Contamination Area (SLP-SCA)—Institutional Control/use as backfill in the Sewage Leach Pond** | | |
| **Chemical-Specific ARARs** | | |
| 40 CFR 61.92 | NESHAPS for Radionuclides from DOE Facilities | Applicable |
| 40 CFR 61.93 | Emission Monitoring | Applicable |
| 40 CFR 61.94(a) | Emission Compliance | Applicable |
| IDAPA 16.01.01., .585, and .586 | Toxic Substances | Applicable |
| **Action-Specific ARARs** | | |
| **(8) Sewage Leach Pond—Native Soil Cover** | | |
| **Chemical-Specific ARARs** | | |
| 40 CFR 61.92 | NESHAPS for Radionuclides from DOE Facilities | Applicable |
| 40 CFR 61.93 | Emission Monitoring | Applicable |
| 40 CFR 61.94(a) | Emission Compliance | Applicable |
| IDAPA 16.01.01., .585 and .586 | Toxic Substances | Applicable |

**Table 9-1**. (continued).

| | | |
|---|---|---|
| **(9) Additional ARARs for all Actions at all Sites** | | |
| **Action-Specific ARARs** | | |
| 40 CFR 262.11 | Hazardous Waste Determination | Applicable |
| IDAPA 16.01.05.005-.011 | Idaho Hazardous Waste Regulations, which reference Federal regulations. | Applicable |
| 40 CFR 268.7, .9, .40, .45, and .48 | Land Disposal Restrictions | Applicable |
| 40 CFR 122.26 | Stormwater Discharge Requirements | Applicable |
| IDAPA 16.01.01.651 | Rules for Control of Fugitive Dust | Applicable |
| **Chemical Specific ARARs** | | |
| IDAPA 16.01.01.500.02 | Operation of and Air Emissions from Portable Equipment | Applicable |
| IDAPA 16.01.02.299(5)(a)(b) | Idaho Groundwater Quality Standards | Applicable |
| IDAPA 16.01.11.200 | Idaho Groundwater Quality Rule | R&A |
| **(10) To Be Considered** | | |
| DOE Order 5400.3 | Hazardous and Mixed Waste Program | |
| DOE Order 5820.2A, Chapter III | Low-Level Radioactive Waste Management | |
| DOE Order 5400.5 | Radiation Protection Std. | |

Chemical-specific ARARs are usually health- or risk-based numerical substantive requirements of the values or methodologies that, when applied to site-specific conditions, result in the establishment of numerical values. These values establish the acceptable amounts or concentrations of a chemical that may be found in, or discharged to, the ambient environment.

Action-specific ARARs are usually technology- or activity-based requirements for actions taken at a site. Action-specific ARARs generally do not guide the development of remedial action alternatives, but they indicate how the selected remedy must be implemented.

A number of statutes have requirements related to activities occurring in particular locations. For instance, waste management activities in flood plains are restricted under RCRA. Location-specific ARARs are regulatory requirements placed on activities in specific locations that must be met by a given remedial action. These location-specific ARARs are used in conjunction with chemical and action-specific ARARs to ensure that remedial actions are protective of human health and the environment.

The following information provides a general discussion describing why a requirement is either applicable or relevant and appropriate at each of the sites of concern.

**Warm Waste Pond**—National Emissions Standards for Hazardous Air Pollutants (NESHAPS) for radionuclide emissions from DOE facilities is applicable to this activity because radionuclides may be suspended during soil movement and consolidation. The radiation dose to the public will be estimated and included in the annual INEEL calculations and reports. If radionuclides associated with fugitive dust releases exceed acceptable standards (10 mrem/yr to the public), then the need for additional measures will be evaluated and implemented as appropriate.

The requirements of 40 CFR 264.309 and 264.310, included in Table 9-1, are relevant and appropriate because of recent information that shows RCRA-listed constituents were likely disposed to the Warm Waste Pond. The requirements of 40 CFR 264.310 (a) (1) and (5) may be met by demonstrating that no unacceptable risk is present via the groundwater pathway. It is anticipated that such a determination could be made for the 1964 cell, but is not anticipated for the 1952 or 1957 cells.

Idaho rules for toxic air emissions are applicable because they also address releases or emissions of radionuclides to the atmosphere, such as may occur during soil movement and consolidation.

**Chemical Waste Pond**—NESHAPS for radionuclide emissions from DOE facilities is applicable to this activity because radionuclides may be suspended during soil movement and consolidation. The radiation dose to the public will be estimated and included in the annual INEEL calculations and reports. If radionuclides associated with fugitive dust releases exceed acceptable standards (10 mrem/yr to the public), then the need for additional measures will be evaluated and implemented as appropriate.

Idaho rules for toxic air emissions are applicable because they address mercury and radionuclides emissions to the atmosphere, such as may occur during soil movement and consolidation.

The Chemical Waste Pond is a land disposal unit. The agencies deem this risk-based CERCLA remedial action to be functionally equivalent to RCRA corrective action requirements to eliminate unacceptable risk. Administrative RCRA closure requirements will occur separately from the ROD after the remedial action is completed. However, the requirements of 40 CFR 264.309 and 264.310, as listed in Table 9-1, would be appropriate performance standards and, therefore, can be considered relevant and appropriate for this action. If excavation and disposal were to occur, waste would be managed in accordance with the outcome of a hazardous waste determination conducted at the time of the remedial action (e.g., treatment of contaminated soil to at least 0.2 mg/L TCLP for mercury).

**Cold Waste Pond**—NESHAPS for radionuclide emissions from DOE facilities are applicable to this activity because radionuclides may be suspended during soil movement and consolidation. The radiation dose to the public will be estimated and included in the annual INEEL calculations and reports. If radionuclides associated with fugitive dust releases exceed acceptable standards (10 mrem/yr to the public), then the need for additional measures will be evaluated and implemented as appropriate.

Requirements for hazardous waste determinations and for management of hazardous waste are applicable during excavation and disposal. While unlikely, sediments may exhibit a characteristic of a hazardous waste. If so, sediments must be managed and disposed as hazardous waste.

Idaho rules for toxic air emissions are applicable because they address radionuclide emissions to the atmosphere, such as may occur during soil movement and consolidation.

**Soil Surrounding Tanks 1 and 2 at Building 639 (TRA-19)**—NESHAPS for radionuclide emissions from DOE facilities are applicable to this activity because radionuclides may be suspended during soil movement and consolidation. The radiation dose to the public will be estimated and included in the annual INEEL calculations and reports. If radionuclides associated with fugitive dust releases exceed acceptable standards (10 mrem/yr to the public), then the need for additional measures will be evaluated and implemented as appropriate.

Requirements for hazardous waste determinations and for management of hazardous waste are applicable during excavation and disposal. When contaminated soil is eventually excavated, then requirements for hazardous waste management and disposal are applicable, because the soil may contain RCRA-listed hazardous waste from warm and/or hot waste system leaks. If so, sediments must be managed and disposed as hazardous waste.

Idaho rules for toxic air emissions are applicable because they address radionuclide emissions to the atmosphere, such as may occur during soil movement and consolidation.

**Brass Cap Area**—NESHAPS for radionuclide emissions from DOE facilities are applicable to this activity because radionuclides may be suspended during soil movement and consolidation. The radiation dose to the public will be estimated and included in the annual INEEL calculations and reports. If radionuclides associated with fugitive dust releases exceed acceptable standards (10 mrem/yr to the public) then the need for additional measures will be evaluated and implemented as appropriate.

Requirements for hazardous waste determinations and for management of hazardous waste are applicable during excavation and disposal. When contaminated soil is eventually excavated, then requirements for hazardous waste management and disposal are applicable, because the soil may contain RCRA-listed hazardous waste from warm and/or hot waste system leaks. If so, sediments must be managed and disposed as hazardous waste.

Idaho rules for toxic air emissions are applicable because they address radionuclide emissions to the atmosphere, such as may occur during soil movement and consolidation.

**Soil Surrounding Hot Waste Tanks at Building 613 (TRA-15)**—NESHAPS for radionuclide emissions from DOE facilities are applicable to this activity because radionuclides may be suspended. The radiation dose to the public will be estimated and included in the annual INEEL calculations and reports. If radionuclides associated with fugitive dust releases exceed acceptable standards (10 mrem/yr to the public), then the need for additional measures will be evaluated and implemented as appropriate.

Idaho rules for toxic air emissions are applicable because they address radionuclide emissions to the atmosphere, such as may occur during soil movement and consolidation.

**Sewage Leach Pond Berm and Soil Contamination Area (SLP-SCA)**—NESHAPS for radionuclide emissions from DOE facilities are applicable to this activity because radionuclides may be suspended during soil movement and consolidation. The radiation dose to the public will be estimated and included in the annual INEEL calculations and reports. If radionuclides associated with fugitive dust releases exceed acceptable standards (10 mrem/yr to the public), then the need for additional measures will be evaluated and implemented as appropriate.

Idaho rules for toxic air emissions are applicable because they address radionuclide emissions to the atmosphere, such as may occur during soil movement and consolidation.

### 9.2.1 Additional ARARs

A hazardous waste determination is required for all waste generated during remedial activities. All selected remedies at WAG 2 that result in generation of hazardous waste will be required to adhere to pertinent substantive RCRA requirements (e.g., LDR standards) during excavation, storage, transportation, treatment and disposal activities.

All selected remedies at WAG-2 that result in hazardous waste storage or soil movement or excavation will be required to apply requirements to prevent contamination of storm water runoff into waters of the United States.

Remedial actions taken at WAG 2 must protect groundwater and demonstrate that water quality specifications found in the Idaho Water Quality standards and under the Idaho Groundwater Quality Rule will be met or achieved.

Any remedial activities that may result in generation of fugitive dust are subject to Idaho requirements for preventing escape, suspension, or release of fugitive dust.

Remedial activities at WAG-2 may require various types of portable equipment. Portable equipment and air emissions from portable equipment must meet requirements specified in Idaho Air Quality regulations.

### 9.2.2 To Be Considered

DOE orders will be evaluated as To-Be-Considered, especially in the absence of applicable state or federal regulation. DOE Order 5400.3 requirements address programs for managing hazardous and mixed waste.

DOE Order 5400.5 provides guidance on radiological environmental protection requirements and guidelines for cleanup of residual radioactive material and management of the resulting waste and residue and release of property. This order shall be used in lieu of applicable state or federal groundwater standards for radionuclides.

DOE Order 5820.2A provides guidance on disposal of low-level radioactive waste at DOE facilities.

## 9.3 Cost Effectiveness

Table 9-2 summarizes the estimated costs in net present value for the five alternatives at each site of concern. These costs were estimated assuming annual inflation rate for the first 10 years and a constant 5% annual inflation rate after that. A constant 5% discount rate is assumed. Each remedial action selected is cost effective because it provides overall effectiveness in meeting the remedial action objectives proportionate to its costs. When compared to other potential remedial actions, the selected remedies provide the best balance between cost and effectiveness in protecting human health and the environment. Please note that the WAG 2 comprehensive feasibility study eliminated the Limited Action alternative on the basis of effectiveness for all sites, except the Sewage Leach Pond Berms and Soil Contamination Area and Soil Surrounding Hot Waste Tanks at Building 613 (TRA-15). Therefore, Limited Action costs are presented only for these two sites in Table 9-2.

At the Warm Waste Pond, initial construction costs are higher than for the native soil cover. However, the Engineered Cover provides greater protection for a longer period of time with less maintenance required, thereby making this alternative more cost effective in the long run. The costs of monitoring, access restrictions, and surface water diversion are nearly the same for the engineered barrier and the native soil cover. Long-term air monitoring requirements are relatively low, assuming the air monitoring would be performed as part of INEEL-wide programs.

At the Sewage Leach Pond, where a Native Soil Cover will be employed, the cost is based on constructing the native soil cover, installing surface-water diversion controls, using monitoring equipment, conducting analyses, and post-closure monitoring and maintenance for at least 100 years. It is expected that a higher level of maintenance will be required for the native soil covers when compared to the engineered barrier.

At the Chemical Waste Pond, if a Native Soil Cover will be constructed, the cost is based on constructing the native soil cover, installing surface-water diversion controls, using monitoring equipment, conducting analyses, and post-closure monitoring and maintenance for at least 100 years. If excavation, treatment, and disposal are selected as part of this alternative, the cost is based on the excavation of mercury-contaminated soils below 260 ppm, treatment using a solidification process such as grouting or chemical stabilization, and disposal offsite at an approved hazardous waste landfill.

For the Excavation and Disposal alternative at the Cold Waste Pond, initial implementation costs are higher than the other alternatives considered. However, by removal of contaminants, the requirement for long-term maintenance and monitoring is eliminated, making this alternative cost effective proportional to its effectiveness in protecting human health and the environment.

For the Sewage Leach Pond Soil Contamination Area, TRA-15, TRA-19, and the Brass Cap Area, the overall cost of the Limited Action remedy compared to effectiveness is low. The cost compared to

**Table 9-2.** Summary of alternative cost estimates for the eight sites of concern.

| Site | Alternative 1 No Action ($) | Alternative 2 Limited Action ($) | Alternative 3a Containment w/Engineered Cover ($) | Alternative 3b Containment w/Native Soil Cover ($) | Alternative 4 Excavation, Retort Disposal ($) | Alternative 4a Excavation, Solidification, Disposal | Alternative 5 Excavation and Disposal ($) |
|---|---|---|---|---|---|---|---|
| Warm Waste Pond (TRA-03) | 3,247,554 | N/A | 6,843,216 | 9,890,638 | N/A | N/A | 30,546,453 |
| Chemical Waste Pond (TRA-06) | 2,954,543 | N/A | 4,352,457 | 3,904,959 | 5,768,466 | 953, 676 | 828,163 |
| Cold Waste Pond (TRA-08) | 2,995,006 | N/A | 5,800,712 | 4,411,567 | N/A | N/A | 1,592,818 |
| Sewage Leach Pond (TRA-13) | 2,954,543 | N/A | 4,475,562 | 4,028,832 | N/A | N/A | 5,320,029 |
| Soil surrounding hot waste tanks at Building 613 (TRA-15) | 2,201,897 | 2,312,337 | 2,703,481 | N/A | N/A | N/A | 2,991,849 |
| Soil surrounding Tanks 1 and 2 at Building 630 (TRA-19) | 2,201,897 | N/A | 6,495,451 | N/A | N/A | N/A | 549,110 |
| Brass Cap Area | 2,201,897 | N/A | 2,700,998 | N/A | N/A | N/A | 548,512 |
| Sewage Leach Pond berms and soil contamination area. | 2,954,543 | 3,497,155 | N/A | N/A | N/A | N/A | 3,457,090 |

N/A = cost considered insignificant or not applicable.

a. All costs in Net Present Value and include contingency. Costs are based on cost estimate entitled "Cost Estimates for OU 2-13 Remedial Alternatives" found in Appendix L of the OU 2-13 Comprehensive RI/FS Report. Net present value costs were estimated assuming variable annual inflation factors for the first 10 years, and a constant 5% annual inflation rate after that. A constant 5% discount rate is assumed.

Shaded boxes indicate costs for the selected remedy for each site.

effectiveness is further decreased for the TRA-19 and Brass Cap Area where eventual excavation and disposal costs will be incurred. However, institutional and administrative costs associated with the Limited Action alternative were based on the assumption that none of these measures are currently in place. On the contrary, administrative and institutional controls are currently in place because TRA facility operations are on-going. The added cost of invoking the Limited Action alternative recommended in this ROD is expected to be minimal. However, a post-ROD evaluation will be conducted to determine what additional administrative and institutional controls will be required as a result of this ROD.

## 9.4 Preference for Treatment as a Principal Element

For radionuclide-contaminated sites, effective treatment technologies that would satisfy this criterion do not currently exist. However, natural radioactive decay will result in the reduction of contaminant concentrations to acceptable levels within approximately 300 years. The EPA's preference for sites that pose relatively low long-term threats, or where treatment is impracticable (e.g., TRA radionuclide contamination) is engineering controls, such as containment.

In the case of mercury contamination at the Chemical Waste Pond, the preference for treatment as a principal element of the remedy will not be fulfilled if the selected remedy is only containment with a native soil cover. However, containment with a native soil cover is appropriately protective of human health and the environment. If excavation, treatment, and disposal are chosen as part of the selected remedy, then the preference for treatment as a principal element of the remedy will be fulfilled. The specific design of the remedy selected, native soil cover with possible excavation, treatment, and disposal after sampling, will depend upon the results of a sampling effort as a first step after the ROD and before the final design is completed.

# 10. DOCUMENTATION OF SIGNIFICANT CHANGES

CERCLA Section 117(b) requires that an explanation of any significant changes from the preferred alternative originally presented in the Proposed Plan be provided in the ROD.

Refinements have been made to the selected remedy for the Chemical Waste Pond. The Proposed Plan recommended containment with native soil cover after excavation, treatment, and disposal of contaminated sediments. A number of possible options for the excavation and disposal part of the remedy discussed in the Proposed Plan were dependent on the levels of mercury found in the pond sediments.

The approach presented in the Proposed Plan can be simplified because the native soil cover alternative will meet cleanup objectives for the Chemical Waste Pond whether or not sediments are excavated and disposed prior to filling the pond to grade. However, it is not clear whether the native soil cover alternative is more cost effective with or without some excavation and disposal of contaminated sediments. Cost effectiveness is dependent on the amount of soil that would need to be excavated, the requirements for its management during and after excavation through disposal (e.g., RCRA requirements for treatment and disposal), and on the rigor of the cover design and the need for long-term monitoring and maintenance. If the amount of contaminated soil that would need to be excavated and the requirements for its management are relatively minor, then excavation and disposal followed by filling the pond to grade with clean backfill materials would likely be the most cost effective. This is because, with the majority of contamination removed, the pond could be filled to grade with minimal backfill specifications, and long-term monitoring and maintenance would not be needed. If larger amounts of soils needed to be excavated and disposed and the levels of mercury in the soil required treatment prior to disposal, then it would likely be more cost effective to design a cover with more strict specifications and to implement long-term monitoring and maintenance of that cover. In order to make a final determination on the design of the native soil cover, further sampling and analysis need to be completed in the pond to define the amount of soil that would require excavation and how the soil would have to be managed and the associated cost.

Therefore, the specific design of the remedy selected in this ROD, native soil cover with possible excavation and disposal after sampling, will be dependent upon the results of a sampling and analysis effort as a first step after the ROD, but before the final design is completed. Figure 10-1 presents a flow chart of this logic.

Recent investigations have determined that RCRA-listed waste may have been present in the TRA warm and hot waste systems when leaks from the systems to the environment occurred. If soil is excavated for disposal, a hazardous waste determination will be required. Therefore, soils at those sites associated with releases from the warm waste system and hot waste system will be managed in a manner consistent with the hazardous waste determination to be performed at the time of the remedial action.

The primary elements of the preferred alternatives for the sites of concern at the TRA remained relatively unchanged. For this reason, the agencies determined that a new proposed plan and public comment period were unnecessary.

The Proposed Plan made the following statement in regards to no action sites: "The No Action status of these sites will be verified on an annual basis to determine whether the status has changed. The concern

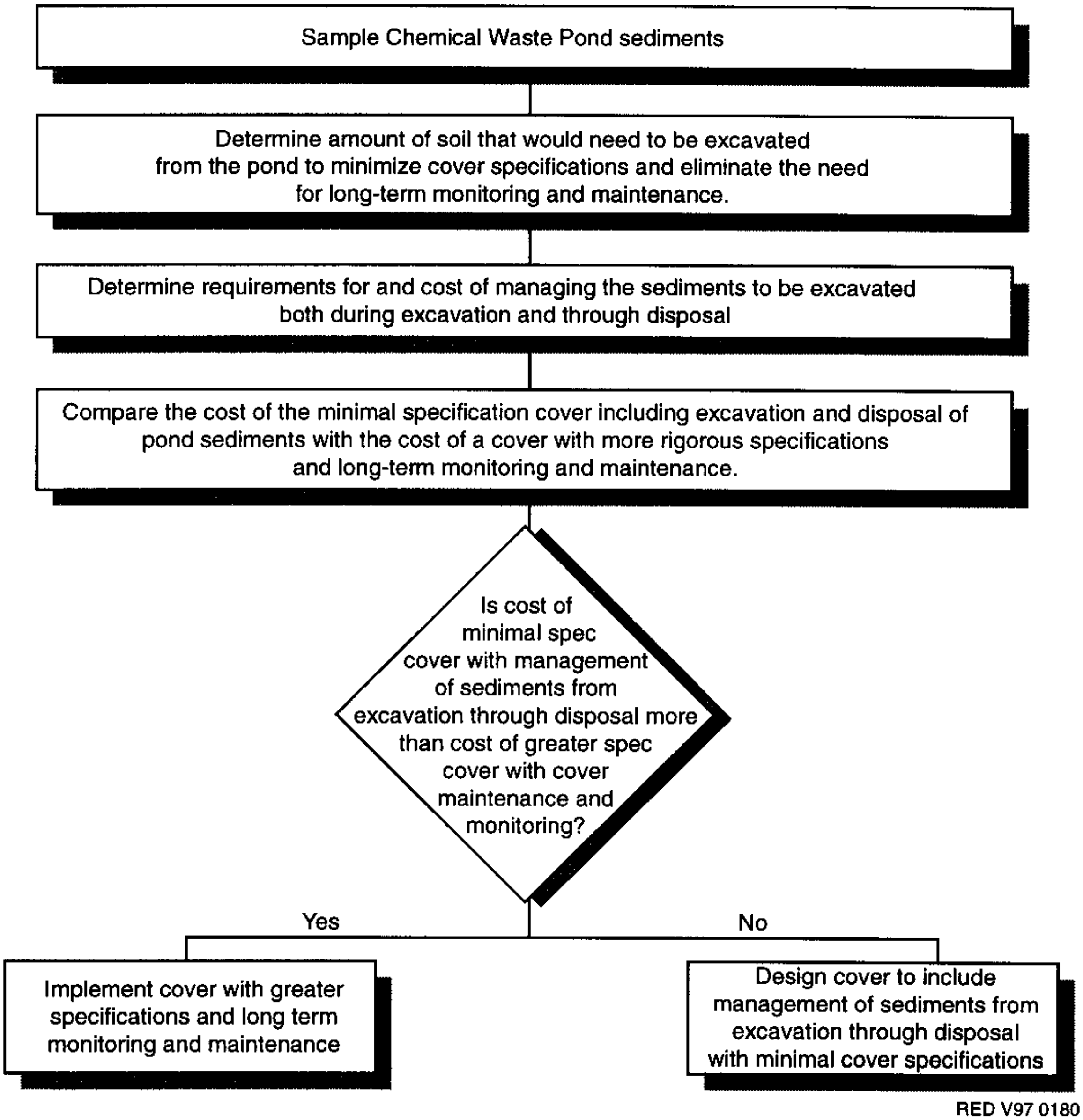


**Figure 10-1**. Chemical Waste Pond logic diagram.

is that the continued operation of the Test Reactor Area may adversely impact these sites, and therefore, such status verification is necessary." This language has been changed in the ROD to be consistent with the NCP. The following language is incorporated in this ROD: "For those sites for which no action is being taken based on land use assumptions, those assumptions will be reviewed as part of the 5-year review."

In addition, the following statement regarding future discoveries of contamination was made in the Proposed Plan: "The possibility exists that contaminated environmental media not identified by the INEL Federal Facility Agreement and Consent Order (FFA/CO) or in this comprehensive investigation will be discovered in the future as a result of routine operations, maintenance activities, and/or decontamination and dismantlement activities at the Test Reactor Area. Future discoveries of radioactively and chemically contaminated environmental media will be evaluated as part of the CERCLA 5-year review process. The 5-year review process will ensure remedial actions and institutional controls are maintained. Five-year reviews will also ensure that any changes in the physical configuration of any Test Reactor facility or site where there is a suspicion of a release of hazardous substances (such as decontamination and dismantlement or facility renovation/modification) will be managed to achieve remediation goals consistent with remedies established for the sites in this proposed plan. Sufficient planning documentation for such actions will be submitted to the agencies before implementation to ensure this consistency."

This language has been changed in the ROD to be consistent with the NCP as follows: "The possibility exists that contaminated environmental media not identified by the INEEL FFA/CO or in this comprehensive investigation will be discovered in the future as a result of routine operations, maintenance activities, and decontamination and dismantlement activities at TRA." "Upon discovery of a new contaminant source by DOE, IDHW, or EPA, that contaminant source will be evaluated and appropriate response action taken in accordance with the FFA/CO."

The Proposed Plan described Alternative 1 as No Action (with monitoring) based on the presumption that contamination would be left in place under this alternative. However, any contamination remaining in place has been determined to not pose an unacceptable risk. Therefore, long-term environmental monitoring is not warranted for the 47 no action sites.

# 11. RESPONSIVENESS SUMMARY

The Responsiveness Summary is designed to provide the agencies with information about community preferences regarding the selected remedial alternatives and general concerns about the site. Secondly, it summarizes how public comments were evaluated and integrated into the decision-making process and records how the agencies responded to each of the comments. Appendix A provides a summary of community involvement in the CERCLA process for OU 2-13 and a summary of comments received and corresponding agency responses.